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Unwanted Creases in

Woven and Knitted Fabrics

Some Useful Facts Concerning a Widespread Dyeing and Finishing Problem

By F. P. W. WILSOME

IN the wet processing of various types of fabric the formation of unnecessary and unwanted permanent creases (often termed "crowsfeet" "cracks", etc.) often constitutes a difficult problem which is sometimes not easily solved. These creases are formed during the processing while the fabric is in a folded condition and while the fibers and yarns constituting the fabric are in a condition particularly susceptible to the influence of the combined factors of heat, moisture, and pressure. The difficulty is thus intimately connected with the plastic properties of textile fibers in general, but in this article attention will be drawn to various instances of unwanted crease formation in cotton, silk, wool, and rayon fabrics where the causation factors were known and where in some instances the necessary preventive measures were discovered.

It may at once be stated that crease formation is dependent essentially on two factors. Firstly, the creases may be facilitated by the plastic properties of the fiber substance as influenced by the existing conditions of heat, pressure, and moisture, and secondly, the weaving or knitting construction of the fabric may be such as is especially favorable to crease formation. Attention must therefore be given both to the nature of the fibers and to the type of weave or knitting.

In the case of special types of fabric, for instance crepe materials, the relatively high twist in the constituent yarns play an important part in crease formation. Special circumstances arise here, and they will receive special consideration.

There is, unfortunately, very little recorded information concerning the plasticity of the various fibers and it is only possible to generalize on this property as a result of everyday practical experience in the wet processing and finishing of various textile materials. From this it would seem that wool, silk, and acetate rayon materials are most plastic, while cotton, viscose rayon, and linen are considerably less so. But all these fibers are plastic under suitable conditions.

As an example of one type of unwanted creasing, reference may be made to the processing of poplin fabrics and also certain kinds of twill fabrics in which the twill appearance is quite pronounced. In the poplin fabric the surface is characterized by the presence of weft ridges formed by a coarse weft yarn interlacing with a finer warp yarn, while in the twill fabric there are diagonal ridges of similar character. Now, in bleaching such fabrics, in preparation for dyeing in rope form it is easily possible to disturb the coarser yarns in relation to the fine yarns so that the ridges are displaced in parts. Apparently owing to the fact that one yarn is considerably finer than the other the yarns do not return to their original positions when the fabric is afterwards opened out to full width and stretched in this condition as in the final stentering process for finishing. The fabric has, in fact, gained permanent creases and these detract from the finished appearance and may render the fabric unsaleable as a first class material.

From examining the creases in such poplin and twill fabrics it is concluded that here there is little influence of the plastic properties of the cotton yarns themselves. The weaving construction of the fabric is the most important factor. What has happened is this: The fabric, in rope form, has been pulled through mangles, pot eyes, and various washing machines while in a folded or creased condition and so assisted the finer warp or weft yarn to slide over the coarser yarn into more stable positions and from which there is no tendency to return to their original positions. Only one method has been discovered which ensures the almost complete removal of the creases and that is mercerization.

In the process of mercerization by which the cotton poplin or twill fabric is treated with caustic soda of about 50° Tw. the individual fibers and the yarns become more rounded or circular in cross-section, this change being the result of the considerable swelling produced by the alkali. Mercerization makes the fibers and yarns smoother so that in the process of stretching, which is carried out

at the same time to give added luster to the fabric, it is possible for them to slide over each other and so destroy the creases originally present.

This crease-removing property of the mercerization process is often valuable in the wet processing of cotton fabrics. Bleaching and scouring in rope form is easily the quickest and cheapest method; it is much better than similar treatment in open width. But with fabrics liable to crease it may be feared that rope treatment may make them defective. The difficulty can, however, be avoided by mercerizing *after* bleaching instead of before as is usually practiced.

It is now possible to turn from woven to knitted fabric. At the present time, one of the most attractive and serviceable knitted fabrics is that known as Milanese. It is a warp knitted fabric which is compact in structure with good strength and extensibility, and when correctly dyed and finished it probably has a better appearance and handle than all other knitted materials. But unfortunately it is most difficult to manipulate in dyeing without causing crease marks which are practically impossible to remove.

Milanese fabric can be made with various rayon yarns and is most popular when knitted from a delustered acetate rayon. A fabric knitted from a viscose rayon, even when this is of the dull type, is considerably inferior as regards softness and fullness of handle. In processing, under the same conditions, milanese fabrics made from bright and dull viscose and acetate yarns, it is noticed, as a matter of practical experience, that all of these fabrics tend to crease. But, without doubt, the dull acetate rayon fabrics are most susceptible to this defect. Bright viscose rayon fabrics crease to a small extent and bright acetate rayon fabrics crease somewhat more, but those made with a delustered acetate yarn most easily become creased. Most probably this creasing propensity is connected with the presence in the delustered yarn of particles of titanium dioxide, for it has been noticed that an acetate fabric delustered by boiling in a soap solution with a small amount of phenol is not so liable to crease as one made from the pigmented delustered yarn.

With this fabric it is therefore evident that creasing is partly caused by the nature of the yarn and partly by the peculiar type of knitting. A fabric of the locknit type made with similar delustered acetate rayon yarn is much less liable to crease during scouring and dyeing.

If a badly creased milanese fabric be carefully examined it can be seen that along the lines of crease the stitches are displaced, and no matter how the fabric is pulled it is not possible to cause the stitches to assume their correct positions. There is only one method for partly obscuring the creases and that is to stretch the fabric to a somewhat greater width than usual in the finishing process and leave it at this width.

Attempts have been made to remove the creases by the following method: Firstly, the fabric is thoroughly soaked in water so as to become as plastic as possible, then finished with excessive stretching in the width, followed by re-wetting, and finishing at the correct smaller width. It was hoped that in this manner the stretching would flatten out the creases. Unfortunately, with the re-finishing, the creases returned just as prominently as before.

An alternative attempt at crease-removal comprised the following operations: The fabric was steeped overnight in a 20% solution of acetic acid at ordinary temperature so that the acetate yarn would become very plastic. The fabric was then finished over width, then washed and again finished to the correct width. Under these conditions the creases were made slightly less prominent, but the treatment could not be considered successful.

It has been concluded that once creases are formed in dull acetate rayon milanese fabric there is no possibility of removing them without radically altering the character of the fabric, as for example, by calendering, hot pressing, or even embossing with a patterned effect suitable for covering the creases.

As indicated above, locknit fabric made with dull acetate rayon is also liable to crease, but to a much smaller extent.

Both milanese and locknit-fabric are usually scoured and dyed on a winch machine and it is in this process that the creases are introduced. The fabric is first sewn at its edges so as to form a tubular fabric. It is then scoured in a winch machine with a liquor containing soap, a wetting agent, and a solvent such as xylene. Afterwards, the fabric may be bleached if very pale bright shades are required, say Sky Blue, but otherwise it will at once be dyed in the same liquor by means of suitable acetate rayon dyes.

It may be considered that the temperature of scouring and dyeing will have an influence on the creasing that is produced. Numerous experiments have shown that it matters little whether dyeing is carried out at 50 or 95° C., creasing appears to take place equally easily. Also, previous soaking of the fabric in cold water before scouring and dyeing is ineffective in preventing creasing. There can therefore be no doubt but that the knitting construction of a milanese fabric is such as to make it especially liable to crease, and considered from this point of view the fabric is a thoroughly bad one.

Actually there is probably no better quality fabric than a well knitted and dyed and finished milanese fabric made from dull acetate rayon, and it is therefore to be hoped that knitters can find some means for slightly altering the method of knitting so as to reduce the creasing properties of the fabric without at the same time substantially altering its other good qualities.

Difficulty can also be experienced in the scouring and dyeing of wool fabrics owing to a tendency for them to become permanently creased. Wool, of course, is under moderate conditions of heat and pressure, a fiber easily susceptible to distortion. The hot pressing of wool mate-

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Moisture Content

As Related to the Finishing of Woolens

By G. L. ATKINSON

IT IS only recently that moisture content has been regarded as a source of preparing and finishing troubles, at least in actual practice. There is no doubt, however, that a study of both preparing and finishing methods with regard to actual running of the cloths brings some interesting information that has puzzled the practical man, theorist, customer and manufacturer alike.

The use of finishing preparations has undoubtedly had promising results on goods that were otherwise unsatisfactory when finished out in the usual manner. The same applies to two processes that are as old as the industry itself, namely, damping or dewing. The prime object in damping or dewing coating fabrics is to gain condition in order that the pressing may be assisted to the utmost degree, and that the very finest results may be obtained with regard to finish and handle.

This demonstrates the object in damping or dewing goods, that have been correctly prepared in the first instance. Then the question arises, how many cloths are correctly finished? If the cloths are not correctly finished then the objects in view with regard to either the damping or dewing of the cloth are vastly different, and it will be found that in ninety per cent of cases, the cloths are damped because they are short of moisture, this moisture arising from various causes. It is in short, although not many finishers will acknowledge the fact, an attempt to introduce moisture into the goods just previous to the final finishing out by artificial means in order to obviate harshness in the final finish, which a reduction in the moisture content of the cloth will undoubtedly cause.

If this fact is acknowledged, and it has to be sooner or later if one would continue in business, then the factor of moisture content of any type of fabric becomes of supreme and vital importance.

It must be admitted in the first place that cloths vary to a considerable degree in their moisture content even in pieces of the same quality received from the loom. In the case of a commission dyeing and finishing concern the variation in the piece goods becomes almost bewildering.

What, however, is often lost sight of is the fact that the variation in the moisture content of the cloths is not so important as preserving to the utmost during preparing and finishing the moisture already existent in the cloths.

The processes and the methods that may spell disaster in that the moisture content of the cloth may be seriously impaired are many and varied and it is only after long and practical experience that these are known, and what is more, the action and reactions of the processes understood. The importance of this question of the moisture content of a cloth becomes more and more apparent when it is realized that a cloth can be correctly prepared and finished and yet the cloth can be far from satisfactory in the matter of handle and finish.

Steam is one of the worst offenders in the matter of the moisture content of any fabric being seriously impaired, this being by either the use of wrong methods or totally wrong application. The worst cases occur where the steam is in direct contact with the fabric as in the crabbing operation. The temperature in the crab bowls is of the utmost importance; if the temperature is low, it generally results in physical faults occurring in the fabric such as improper setting, cockling, crabbing marks, etc. On the other hand, the effects when the steam temperature is too great cannot be seen; they can only be felt when the fabric is finally finished. This is a difficult problem to overcome as most operatives appreciate a fault much better when they can readily see it.

Steaming, however, in the bowls of the crab, does not impair the moisture content of the heavier fabrics such as coating cloths but rather the lighter weights of fabrics, such as dress goods, poplins, repps, etc. The one saving feature here is that the cloths are only rarely in contact with the steam; usually the crabbing liquor in the bowls of the crab is an adequate protection against serious impairing of the moisture content of the fabric.

Another danger exists, however, that can easily occur if stringent precautions are not taken and that is the heating of the crabbing liquor by the use of unsuitable steam. By unsuitable steam is meant steam that is not satisfactory from a purely textile point of view, that is, too dry, or in some cases, superheated steam. There is no doubt that a great deal of difference exists in the matter of moisture content in the fabric, between two cloths of the same quality, when one has been treated with correct steam and one has been treated with too dry or superheated steam. The difference can be detected after the crabbing operation merely by handling of the cloth.

A further point that is not generally known is that sudden application of steam will assuredly result in loss of the moisture content of the wool fibers of the fabric.

This sometimes occurs during the setting of the cloth in the bowls of the crab.

Wool is constantly changing as to moisture content, a fact that not a few concerns fail to appreciate, to their loss. This is perhaps the basic reason why finishing is an art so far as the practical side is concerned and can never be reduced to mere terms and symbols and cannot be wholly standardized.

Wool always requires careful application of steam for this in the first place causes the fibers of the cloth to swell; if on the other hand it is capable of penetrating the fibers of the cloth then the moisture content is seriously impaired. In addition to this each cloth or each fiber in the piece, if it comes to the point, will only take a definite amount of steam and this amount cannot be exceeded without impairing the moisture content of the fabric and ultimately the finish and handle.

More pieces are spoiled in steaming of the cloths during preparing and finishing in the steaming operation than in the rest of the operations put together. Oversteaming of goods, and this means where the amount of steam that the wool fibers of the fabric will take is being exceeded, is one of the commonest causes of cloth being impaired. This often occurs in the steaming of cloths upon the crabbing machine, for the cloth is either in direct contact with the steam, or inadequately shielded by the thin cotton crabbing wrappers.

The pressure of steam at which the pieces are treated is also of vital importance, for if the pressure is too high, the steam used penetrates the fibers of the fabric and the moisture content of the cloth is distributed or impaired.

Although the pressure at which steam is supplied to the machine may be perfectly correct, this is not to say that the pressure realized during the steaming of the cloths is correct; in many cases this is far from the truth. Steam may be utilized at 12 pounds pressure per square inch; when, however, the steam penetrates the piece goods wrapped in roll form, the initial pressure increases as the steam expands outwards as it is forced to do and the pressure may be anything from thirty to forty pounds per square inch, and the results with regard to the final finish and handle of the fabric are vastly different from what the management imagined they would be when the preparing methods were decided upon. In this case, no faults are visible in the fabric, that is physical faults, and in many cases the concern is at a loss to account for the deficiency in handle and finish. A sudden inrush of steam into a narrow steaming can is often responsible for the trouble.

A microscopic examination of a cloth shows that the scales of the fabric have been damaged. If this occurs, as it has in practical experience, such fabrics are deficient in handle when finally finished.

Another point often lost sight of is that the wool is a living organism when taken from the back of the sheep and it is possible by means of incorrect steaming in some form or another to impair its natural properties. In this case the natural moisture in the fibers of the cloth cannot be replaced by any known means and certainly not by any of the machinery.

Such cloths that are killed during the preparing operation are always deficient in handle and finish. In this case the fault is not always noticeable until the cloths enter the finishing room or until they have been dried after dyeing. A certain test is to lightly damp the goods and leave them in piles under damp wrappers. If the cloths have been correctly prepared they will heat up of their own accord, as the cells of the fibers absorb the fluid which was placed upon the surface of the cloth during the damping operation. In two or three hours, a hand placed between the pieces will be found to be quite warm and this assists the natural condition of the cloth.

On the other hand if the wool has been killed during the preparing operations, then the goods do not heat up, and the natural condition of the fabric is not assisted in any way. The moisture applied to the cloths remains on the surface of the fabric and is not absorbed in any way. It will be found by testing the pieces that quite a considerable amount of moisture is lost before the pieces are passed forward for any further process. The only method by which this moisture can be retained in some measure is to dry blow the goods with steam and then cool after steaming by means of the blowing pump of the machine. A considerable amount of heat is developed during the pressing of coating fabrics and quite a large percentage of this moisture is lost during the pressing of the goods. When they are examined and handled after pressing the fabrics are dry and papery in handle. This is entirely due to damage of the minute cell fibers and to loss of moisture content of the cells.

The application of heat also causes swelling in the fibers of the fabric,—the higher the temperature the greater the swelling of the fibers. Heat in the pieces as distinct from pressure and tension leads to distortion, for when the goods are cooled down it is only in rare circumstances that the fibers of the cloth cool in the corresponding manner.

It is necessary after most steaming operations to obtain cooling of the cloths and under present day conditions the goods can never be allowed to cool down naturally. This means that artificial means have to be adopted and the goods are either cooled on the crabbing machine directly after the steaming has been carried out or in a special machine or trough.

Drastic cooling down is responsible for many of the cloths lacking in the matter of moisture content. It should be remembered that the temperature of the crabbing liquor in the bowls of the crab and where the cloth is not in direct contact with the steam is generally sufficient during the setting of the fabric to reduce it to the plastic state. In the case of open steaming on the roll of the crab this fact of the goods being in the plastic state always occurs and if steaming is correctly carried out and the cells are

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Notes on Processing Cutch

By **R. F. HOLTKAPP**

CUTCH, or catechu, is one of the natural coloring matters which is still extensively used in dyeing certain kinds of cotton and jute fabrics. The color is very fast to light and hard wear, moreover, the dyed material resists mildew and water rot, hence cutch is employed in dyeing fish netting and sailcloth in the well known orange-brown shade. Jute and cotton mail bags used in some European countries are exclusively dyed with cutch. The dyewood is also favored for the processing of fabric covers for musical instruments; the cotton stretcher fabric used for ambulance biers is usually dyed with cutch. Textile material processed with cutch develops a hard, boardy handle which in some instances is an asset to the ultimate finish of the fabric. On the other hand, the characteristic hard handle of cutch-processed material prevents the dyewood from being used in the coloring of materials which must have a soft supple handle when finished.

The coloring principles in cutch are catechutannic acid and catechin; these are not strongly colored bodies of themselves but they will combine with certain metallic salts to produce strongly colored lakes which are very fast to light and washing on textile material. The principal developing substances used with cutch comprise copper sulfate, iron sulfate and bichrome. Of these, bichrome yields the most useful shade, namely, a rich orange-brown of remarkable body. Iron sulfate develops a dull, flat brown which, though very fast to washing and light, is of too lifeless a character to be generally useful. Nevertheless, iron sulfate forms a useful adjunct for use in modifying the red tone of chrome-developed cutch since an addition of the iron salt turns the shade towards the olive side. The chief use of copper sulfate in processing cutch is in the role of an oxidizing agent for use along with the cutch. Amounts of copper sulfate varying from 2 per cent to 5 per cent on the weight of cutch taken are put in the bath when dissolving the cutch. Copper nitrate has also been used as an oxidizer for the coloring principle of the cutch; this salt is rather more effective for the purpose than the sulfate, with the result that a stronger color ultimately develops; the disadvantage is the higher cost of the copper nitrate.

In order to produce clean shades with cutch, two baths must be used. The material to be processed is first boiled in the solution of cutch, then allowed to steep for a period; the batch is then lifted and squeezed thoroughly and finally treated in a boiling bath charged with 5 to 10 per cent of bichrome in order to develop the shade. This is the simplest method of applying cutch to cotton or jute stock. One of the darwbacks lies in the employment of copper sulfate in the same bath with the cutch; this means a certain amount of loss through the formation of a lake, hence to process deep shades in the presence of the copper salt requires high percentages of each.

In order to economize in cutch, it is the practice in some plants to omit the copper sulfate and to apply the cutch together with about 2 per cent of acetic acid. The material to be dyed is entered into the boiling bath and boiled for one-half to one hour, the duration here being varied in accordance with the thickness of the goods. After the bath has been boiled for the period found most suitable, steam is cut off and the batch is allowed to steep in the cooling liquor overnight; in some instances, the material is only steeped one hour, it then being taken out of the apparatus and after being squeezed or centrifuged, thrown into a heap while still warm and left overnight. During this period the cutch on the fiber slowly oxidizes, with the result that a deep color is obtained upon the customary development with bichrome.

While the process just outlined is suitable for use with deep shades on yarn and raw stock, it is unsatisfactory when applied in the case of piece goods because the color develops unevenly owing to irregular oxidation of the cutch. In order to overcome this, the pieces are impregnated with cutch in the jig and after being centrifuged, they are steamed for about half-an-hour in an ager; after this, the material is hung full width in a shed until it has become dry. As a rule, just sufficient heat is used to ensure that the fabric becomes barely dry in about twelve hours. By this time, the coloring matter on the fiber has been properly oxidized.

The next step is to develop the shade with an appropriate amount of bichrome, or bichrome and ferrous sulfate. This operation is performed on the jig, the material being run at full speed into the boiling bath, which has already been charged with one-half of the full amount of bichrome, etc., the remaining quantity being used when the pieces have been circulated a few times. In order to assist in the development of a level color, it is wise to employ a hot and fairly strong developing liquor in order to fix the cutch as soon as the fabric comes into contact with the solution, thus preventing the tendency of uncombined coloring matter to leave the material in streaks and patches upon wetting.

Thorough oxidation of the cutch on the fabric previous to development has a favorable influence upon ultimate levelness of the processed goods inasmuch that imperfectly oxidized cutch is more easily removable from the fiber during hot aqueous treatment of the goods than is well oxidized cutch. It will now be perceived why thorough and regular oxidation of cutch impregnated material is advantageous towards securing levelness in shade after development. If impregnation with cutch is carried out in the presence of soda ash, oxidation is accelerated during the ageing process; the effect of the alkali on the shade of the undeveloped material is to turn it a browner hue than goods processed with cutch in the presence of acetic acid, or with no assistant at all. Impregnation in the presence of 1 per cent of soda ash assists the levelling of the cutch when processing a pale hue with cutch.

The presence of copper in combination with the cutch in material to be developed with bichrome results in the production of quiet tones of brown which do not have the reddish tint of cutch shades processed in the absence of copper salts. Copper sulfate gives an olive-brown color when used alone as a developer for cutch; the resultant shade is by no means so intense as in a case where bichrome has been used for the developing agent. To produce a full brown shade on cotton yarn or warp requires the employment of about 1 pound of cutch per 3 pounds of material to be dyed; if copper sulfate is chosen for the assistant, about 2¼ ounces of this will be needed for 3 pounds of cotton material. To develop the shade, from 3 to 4½ ounces of bichrome should be allowed per 3 pounds of goods. These amounts should be cut by one-third when stuffing the bath for another batch, if using the same liquor again.

Some dyers do not favor the continual use of a standing bath because they consider the dyeings duller than one processed in an original bath; furthermore, the color is apt to be dirty owing to the presence in the standing bath of considerable amounts of copper-cutch lake and impurities from the cutch and material previously processed in the bath. When applying cutch to cotton or jute piece goods, it is advantageous in the matter of achieving levelness to dispense with a standing bath if copper sulfate is employed as an oxidizing agent. The bath may be prepared with cutch alone, the goods being run straight into the boiling liquor. It is preferable that the material should have previously been wetted and centrifuged before entering the cutch bath. When the fabric has become well saturated with the cutch liquor, the requisite amount of copper sulfate may be used; it is best to dissolve the bluestone in a suitable volume of boiling water before using it. This solution must on no account be put in the bath in one addition, under penalty of unlevelness developing; it is more practical to divide the full quantity over several ends. Boiling of the bath should then continue for 15 to 30 minutes in order to level up the color. If a pale hue is being processed, ageing can be proceeded with as soon as it is considered that the levelling operation is complete; in the case of deep shades, the batch must be run for a period in the cooling bath in order to build up the intensity of color. Hydro-extraction of impregnated material must be performed in a thorough manner since wet patches in the pieces interfere with regular oxidation of the cutch during the ageing operation, and tend to produce unevenness during development with bichrome.

Another important point to watch when processing cutch is in obtaining perfect solution of the substance. If cake cutch is used, the cakes should be broken up into small pieces before charging the dye kettle or other receptacle used for dissolving the dyeware. Some plants have installed a chopping apparatus resembling a printers' guillotine to facilitate the breaking up of cake cutch. The water in the kettle should be briskly boiling before the cutch is put in; owing to the tendency of cutch to settle in a sticky mass at the bottom of the kettle, the bath should be vigorously raked, with the object of preventing the formation of these tarry masses. The granular form of cutch offers less difficulty in dissolving but, even with this kind, one should be on the lookout for tarry lumps stuck to the bottom of the kettle. An addition of a small amount of soda ash to the bath when dissolving the cutch often helps in dissolving the substance since the resinous bodies it contains are more soluble in alkaline solution than in acid or neutral liquor. Some dyers prefer to use the granular variety of cutch because its tinctorial strength does not vary from batch to batch as in the case of different shipments of cake cutch. The producers of granular cutch handle large amounts of the raw material at a time and by blending the different grades sent in by the native collectors of the commodity, a standardized product is made available.

There are several ways of modifying the straight shade of cutch on cotton and jute goods; for instance, by using logwood, fustic or bark extracts along with the cutch in the impregnating bath; by additions of substantive dyes along with the cutch; by topping the developed shade with basic colors, or certain chrome dyes; by using iron sulfate alone or in conjunction with bichrome for development. If shading is carried out with logwood, the fastness to light is inferior and the tone alters during acid cross-dyeing of woolen goods into which cutch-dyed yarn is entered. In some cases, substantive dyes may be found useful for shading, except where a high fastness to light and soap fulling is wanted. Basic colors topped on cutch-dyed material do not usually show good fastness to light, but the fastness to acid cross-dyeing of toppings of Methyl Violet BB and Victoria Blue B is fairly good. Certain chrome dyes show good fastness to light and soap fulling when used for topping cutch dyed cotton and jute material. Chrome browns of the Metachrome Brown B and Metachrome Olive Brown G types, Alizarine Red S and Anthracene Yellow types, comprise suitable topping colors of the chrome color class, but they should only be used for light toppings since they prove wasteful for use where a considerable modification in the tone of the cutch-dye is

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Power and Heat

For Textile Dyeing Plants

Advantages of the Turbine

By C. H. S. TUPHOLME

A GREAT deal has been said and written on the chemical side of textile dyeing and finishing plants, but one hears not so much about the question of heat supply, both for processing and heating buildings, yet this question of heat is important and enters into the cost of the finished product. On the other hand, while many textile plants employ the most up-to-date methods in the actual chemical processing, the power side of their operations seldom receives anything like the same attention.

Large quantities of steam are required in the textile industries for heating purposes, mostly at pressures less than 110 lb. per sq. in. Pressure is indeed often only needed to overcome passive resistances, temperature being the vital requirement. Rayon works require steam, for example, at 70 to 85 lb. per sq. in. Such steam is generally saturated and raised in boilers at a slightly higher pressure.

As far as steam-raising is concerned, it is important to remember that the total relative heat of steam is represented by 1,145 at atmospheric pressure, 1,180 at 70, and 1,190 b.t.u. at 140 lb. per sq. in., respectively, so that the high pressures only demand an additional heat supply of 2.83 and 3.85 per cent. The extra heat needed to obtain steam at higher pressures increases very slowly and reaches a relative maximum of 1,200 b.t.u. at about 425 lb. per sq. in., an excess of only 4.55 per cent above that just required to convert the water into steam at atmospheric pressure. This has brought about the use of ever-increasing pressures, often as high as 1,700 lb. per sq. in., but at present more usually limited to about 850 lb. in super power stations and 500 lb. per sq. in. in ordinary works plants.

Heat is liberated (principle of conservation of energy) when high pressure steam expands to a lower pressure, which heat can be converted into power by a suitable engine. Additional heat is obtainable by superheating (general limit about 750 deg. F.) at slight extra fuel cost, but recuperated by the extra power developed by the engine. A typical example will illustrate the saving possible when low pressure steam is obtained by the expansion of highly pressed steam combined with power production.

A textile process, for instance, requires 10 tons per hour of steam at, say, about 20 lb. per sq. in.; starting from the total heat required and assuming a boiler efficiency of 75 per cent, with coal of good commercial quality, the amount of latter required in direct production will be about 2,400 lb. per hour. Supposing now that steam is raised at 355 lb. per sq. in. superheated to 705 deg. F. and allowing for the slightly better efficiency of high pressure boiler plant (say 80 per cent) the fuel consumption will amount to about 2,670 lb. per hour or only 270 lb. more than previously. Deducting losses and taking the exhaust pressure at 20 lb. per sq. in. the available steam utilized in a turbine will produce 800 kw., so that finally this power will have been obtained at the cost of only 270 lb. of fuel, that is, 0.338 lb. per kw. hr., or substantially less than the best results of mammoth power stations, equipped with every conceivable device for maximum economy.

The pressure and superheat to adopt depend entirely on the temperature of exhaust steam required; a slight superheat is advantageous to ensure dryness, with consequent maximum heating effectiveness. In passing through a turbine, friction and other losses prevent total conversion of the heat drop into energy, but the difference, about 20 to 25 per cent, almost wholly reappears as superheat in the exhaust.

In many cases much of the steam pressure is absorbed in overcoming passive resistances in existing pipelines, to no useful purpose; a reduction of this loss, like an increase in steam pressure, can effect a considerable saving. If, for example, the exhaust pressure can be reduced from, say, 45 lb. per sq. in. to 30 lb. by larger piping, starting with steam at 355 lb. per sq. in., 705 deg. F., the additional heat drop convertible into power would be equivalent to that given by an initial pressure of 480 lb. per sq. in. at the same superheat. Partial or total replacement of existing pipelines may thus be quickly recouped by increased power production, each case, of course, requiring special consideration of all factors.

Many plants cling to the older reciprocating engines, though when extensions or replacements are being considered, the turbine should be very thoroughly investigated. The well-established superiority of steam turbines for large powers has ensured their adoption in practically all important power stations, reciprocating engines now

being the exception in new plants. For small powers, say 200 bhp. and under, many plant owners, however, hesitate to put them in, partly on account of their (comparative) novelty, and their high speed, this being supposed unfavorable to reliability. Lengthy practical experience as well as theory has, however, proved this objection to be nothing more than unfounded prejudice, and the advantage of turbines for small powers is well exemplified by the following:

It has already been shown that very little more heat (that is, fuel) is needed to generate the same amount of steam at high as at low pressure, and a turbine interposed between boilers and low-pressure heating appliances acts as an excellent reducing valve, generating power in so doing at unapproachably low cost. The reason for this is that all heat not utilized by the turbine in power production remains contained in the exhaust (instead of being lost in the condenser), so that, apart from radiation and conduction losses, power is produced with 100 per cent efficiency; in other words, every 1,140 b.t.u.—equivalent to less than one-quarter lb. of good coal at 80 per cent boiler efficiency—generates 1 b.h.p. for an hour at the turbine coupling.

A reciprocating engine could, of course, be applied in the same way, but the practical advantages of the turbine remain preponderant; lower first cost, greatly reduced bulk, absence of heavy, expensive foundations, negligible cost of lubrication, upkeep and repairs, absolutely vibrationless running, quick starting without preliminary warming up are very important adjuncts to complete reliability.

Another special advantage peculiar to the turbine alone must be specially stressed, namely, the absolutely clean exhaust. This is of paramount importance for uses in which the steam is allowed to come into contact with the goods to be treated, e.g., to bubble into a vat containing textiles, which must be kept free from the least trace of oil. Turbine exhaust can be used in such cases without hesitation, whereas no maker of oil separators will guarantee absolutely complete extraction of oil from the exhaust of a reciprocating engine.

The low cost and extreme ease of erection of turbines render them particularly suitable for small powers, or as standby sets, from which latter purpose the cost of a reciprocating engine would be out of all proportion to the benefits obtained.

Quite apart from the question of heat supply, it must be remembered that plants taking their power from a central station may find themselves in an embarrassing position when for any reason the current fails (accident to cables, short circuit, station breakdown, etc.), quite apart from losses arising from partly manufactured products spoiled or otherwise rendered useless. Such accidents (some on the largest scale) have not been infrequent in central plants, and in such cases the small turbine, which can be started immediately without preliminary warming, is a valuable auxiliary and pays for its cost in keeping the works going.

Fitted to fulfill the office of a reducing valve between boilers and low pressure vats or systems, the small turbine generates power (as already set forth) at the extreme minimum of cost. As the small turbine runs much faster than any dynamo or alternator, the two are coupled through a reducing gear; such gear has now attained a degree of perfection and reliability adapting it to all purposes, up to the propulsion of the largest liners or warships.

MOISTURE CONTENT AS RELATED TO FINISHING OF WOOLENS

(Continued on Page 388)

not damaged or the fibers of the cloth killed cooling down results in the cloth being spoilt.

To be correct the fibers should cool down in the same manner and should retain the same characteristics as when they were steam treated; this seldom happens, as the cloth is too drastically cooled down and the cloth is spoilt. Cooling down should be carried out very gradually no matter what the type of cloth.

It can be stated quite positively that the crabbing and steaming processes are responsible for loss of moisture content, killing of the fibers, and damage to scale cells. The preparing operations are the worst offenders, the dyehouse occasionally with certain types of fabrics, and the dry blowing in finishing practically only when damage has been caused in preparing. The following are the approximate percentages of the named operations during which such injury occurs:

Crabbing in the bowls of the crab	25%
Steaming on roll	60%
Dyehouse	10%
Dry steaming in finishing	5%

NOTES ON PROCESSING CUTCH

(Continued from page 390)

wanted. The topping process is best carried out at the boil, especially if the material is to be entered into woolen goods which will require dyeing with acid colors. Chrome browns of the Metachrome Brown B and Olive Brown G types may be used for heavy toppings on jute goods dyed with cutch. In this event, the topping process should be carried out at the boil in the presence of 1 per cent of bichrome and 2 to 3 per cent of acetate of ammonia. The resultant shades show very good fastness to light and fulling with soap.

PROCEEDINGS OF THE
American Association of Textile Chemists and Colorists

JULY 15, 1935

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Members should notify the **Secretary** immediately of all address changes

NINETY-FIFTH MEETING OF THE RESEARCH COMMITTEE

THE 95th meeting of the Research Committee was held in the Engineers' Club of Boston, on Friday afternoon, June 14th. Present were Chairman Louis A. Olney, presiding; W. H. Cady, Hugh Christison, C. Z. Draves, W. C. Durfee, W. R. Moorhouse, G. A. Moran, B. A. Ryberg, W. M. Scott, and H. C. Chapin.

Recommendations to the Council were voted regarding salaries of the Research Associates, also regarding their working hours, vacations, and certain expenses.

"Specifications of the American Standards Association for Designating Shrinkage of Woven Cotton Yard Goods, L-9," were approved, being in accordance with A.A.T.C.C. specifications, as acknowledged therein.

The Chairman was instructed to obtain a description of Dr. Meyer's crocking test for publication.

"Proposed Commercial Standards for Testing and Rating Dress Fabrics," submitted by Better Fabrics Testing Bureau, Inc., were discussed at length, and Mr. Christison, with Mr. Appel as alternate, was appointed to attend a conference on the subject in Washington on June 22nd.

Mr. Ryberg reported progress on the analytical separation of wool and vegetable fibers.

Mr. Moran presented adverse comments from Mr. Appel upon the dye chosen for cotton washing tests, to the effect that this dye is not listed and is the product of but one manufacturer. In consideration of its suitability in other respects, it was voted to be retained however, with manufacturer's name in statement of test, to avoid annoyance to users. Mr. Moran further reported, with samples for demonstration, on comparisons between scouring tests of the Society of Dyers & Colourists and of this Association. Mr. Durfee suggested a change in design of Launderometer jars to permit automatic venting, rather than attempted retention of excessive vapor pressures.

Ralph Hart, through a letter, suggested publication of tests but once, in loose leaf form, to avoid annually repeated printing in the Year Book. This was discussed, but no action was taken.

Respectfully submitted,

H. C. CHAPIN, *Secretary.*

Proceedings of the American Association of Textile Chemists and Colorists

Cotton Preparation

*with Resist Elimination**

By **R. R. MAGILL**†

THE subject takes us into the study of preparing cotton yarn, piece goods, or raw stock for dyeing. In order to take up this matter we must go into the chemical changes that occur as a reaction from the use of various elements and compounds used to remove from the cotton the waxes, gum pectins, lime, magnesium and other material, and have it stay dyed. If we are to dye or bleach cotton successfully, we do not want to dye or bleach the gums and various foreign substances. We want to dye all of the cotton, and not just the surface, so that when the dyed or bleached material is exposed to further treatment or laundering at a later date, the colors will not wash out or become dull and dingy. We do not want the bleach later to have an overcast appearance or the dyeing to be cloudy or speckled. If the material is to be printed, it is necessary that an even and true penetration be accomplished and that the material so printed possess true colors.

As the result of our objective, we must take into consideration the various problems of valency and electro-molecular activities and reactions, because the materials to be removed from the cotton must be converted into soluble compounds unless we are to leave these undesirable materials remaining in or on the cotton and later find to our sorrow that we have produced a job below the standard of our work and requirements. It appears to us that the source of the present day difficulties in dyeing and finishing are traced to the electronic theory of valency and the continual attempts to maintain the various laws which we learned existed in time past but now are proved erroneous. In early days the subject was comparatively easy. Hydrogen was monovalent; boron was trivalent; carbon was quadrivalent, nitrogen was pentavalent, etc., and all of us were able to draw structural formulae that satisfied public opinion. Inert gases were incapable of forming chemical compounds and all was straight-forward, easy to understand, but inaccurate.

Few chemists will deny that the formation of a shell of eight external electrons fits in quite well with most of our conceptions of chemical combinations. We, in our ignorance, are not sure that the uses of the terms co-valency, electro-valency and coordination are not on a par with defining the visible spectrum in terms of red, yellow and blue only. Are co-valency, electro-valency and coordination anything more than three stages in that spectrum that begins with the highest manifestation of chemical combination and gradually dwindles down to nothing?

This gives reason to the fact that in one mill a certain chemical or compound of chemicals performs to perfection, or a certain combination of chemicals functions ideally, whereas in another mill if the same procedure is carried out, the result is a successful failure. A great many of our present-day penetrants, solvents, levelling agents and softeners are either of the sulfonated fatty alcohol group, analdehydes, sulfonated esters, combinations of these materials or these materials combined with sulfonated oils, or phosphate salts. The phosphate salt referred to in particular is hexametaphosphate, which is sold under the various trade names, and when these materials which I have mentioned are combined with the impurities and undesirable elements existing in the cotton to be processed, various chemical reactions of a complex nature occur, which are governed by the pH, the heat and alkalinity of the solutions and the condition of the water used to combine the elements together; wherefore the various failures of the different marketed products in one mill where the same products prove a glorious success in another. Such facts agree well with the theory of relativity of reactions in proportion to the undesirable substance present when the material is to be prepared for the dyeing or bleaching operation.

Where magnesium or calcium are present in a solution or on the fibers of the material to be processed, hexametaphosphate is an extremely valuable addition, inasmuch as the metaphosphate reacts with the magnesium and calcium to form soluble salts and prevent the formation of insoluble calcium or magnesium soaps or insoluble compositions resulting from the calcium and magnesium uniting with various elements present in the solution. Of course, all of the aforesaid chemical compounds referred to are dependent as to their reaction relatively to the alkalinity or acidity of the solution in which the various processes take place.

*Paper presented at meeting, Piedmont Section, Feb. 16, 1935.

†Technical representative of the Charlotte Chemical Laboratories, Charlotte, N. C.

SECTIONAL SUMMER MEETING

THE second annual joint Sectional summer meeting of Southern Sections will be held at Signal Mountain Hotel, near Chattanooga, Tenn., on Friday, August 2nd, and Saturday, August 3rd. A gala program has been arranged including all kinds of contests with prizes for both ladies and men such as a swimming meet, bridge tournament and golf tournament. Other recreational facilities such as miniature golf, dancing, shuffle board, tennis, riding and hiking are also available. The high point of the outing will be the banquet on Saturday night followed by the Annual High-Jinks and Jamboree. A technical program has also been arranged for the more serious minded members. R. S. Wheeler is chairman of the committee and hotel reservations should be made immediately directly with the hotel.

Proceedings of the American Association of Textile Chemists and Colorists

Characteristics of

Corn Starch and Corn Gums

as Related to Printing Thickeners*

By C. NORRIS RABOLD†

MY PURPOSE in presenting this paper is to bring to your attention a few simple and, probably, to you, well-known facts regarding the structure of cooked pastes made from thick-boiling starch, and paste made from gums and to attempt to explain on the basis of paste structure, some of the common phenomena observed in printing.

This paper naturally divides itself into the following parts:

First: The structure of the corn granule, the changes observed in gelatinization and the nature of the cooked paste.

Second: The same set of observations applied to a converted starch or gum.

Third: The nature and application to cloth of a starch paste with dyestuffs added, and resulting observations.

Fourth: The nature and application to cloth of a gum paste with dyestuffs added, and resulting observations.

We shall confine our discussion entirely to corn starch and the converted products made from it, as we do not feel we can speak with authority concerning products made from other bases. As thick boiling corn starch is a common component of printing pastes and is also the base product from which gums and dextrines are made, we would like to first consider it. We do not feel that some observations as to the structure of the corn granule would be amiss, as these observations have an important bearing upon the use of starch in connection with dyestuffs.

First of all, we all know the corn granule to be an irregular shaped structure showing a definite cross which marks the lines of cleavage. In fact, some of the newest theories concerning starch chemistry assume that a starch granule is really a crystalloid as it exhibits many properties similar to inorganic materials which have definite crystalline structure. At one time it was conceived that the starch granule was a sac-like structure, the outside of which was composed of an insoluble material which we may term A-Amylose and which enclosed a liquid center known as B-Amylose. Today we do not think of the starch granule as being a sac but rather as a more or less homogeneous mixture of A-Amylose and B-Amylose with the preponderance of the A-Amylose on the outside of the granule but also with some distribution of it throughout. The average size of the corn granule varies from 12 to 18 microns, with a number of much smaller granules and a few which would be larger.

Corn starch, and we are speaking of thick boiling starch when we use that term, exhibits the usual properties of thick boiling starch when gelatinized. When the starch is suspended in water and the temperature is gradually raised, we find at 165° to 170° F., a thickening of the starch and water mixture. As the temperature is gradually increased and the heating continued, we find that the starch, after being held for a period of time will decrease slightly from its initial viscosity and will then remain, even though heated at boiling temperature, for a long period of time, with little decrease in viscosity.

If this gelatinization were observed under the microscope we would find there was a marked swelling of the starch granules due to the absorption of water. No longer would the grain of starch be rough and irregular in shape, but would now have a balloon-like appearance and its diameter would have increased to somewhere between 50 and 100 microns. A few of the granules, due to some weakness in their structure, would have burst and would present an opening on their sides, from which, due to internal pressure, the B-Amylose had erupted. The majority of the granules would, however, still be intact. The viscosity of the paste would be caused by each of these large swollen granules having a large amount of its surface in contact with its neighbors. It would thus offer considerable frictional resistance when an attempt was made to move or disturb it.

After the paste has cooled let us examine the structure of the cold jell. What we have is a number of balloon-like granules all touching each other but because of their large diameter, they have necessarily large open spaces between them, in which water is contained. In other words, we may liken the paste to a honey-comb, with the contiguous starch granules forming the comb and the unabsorbed water filling in the open spaces.

The cooking and gelatinization of gums is entirely different physically from the cooking and gelatinization of starch paste. In order to get our terminology clear, it is our practice to classify acid converted products as dextrines, roasted products where heat alone is used to convert

*Presented at meeting, Rhode Island Section, April 26, 1935.
†Corn Products Refining Co.

the starch as British gums, and where alkali is used to help modify the starch as alkali gums. Any one of these may be used as a component of a printing paste, and for the purpose of this discussion we shall speak of them simply as gums, though we may be referring to a Canary dextrine, an alkali gum or a British gum.

The usual method of preparing these products is to introduce the converting agent, if such be used, into the mass of dry starch from which the product is made, and the resulting gum which will be produced will depend first, upon the nature and amount of converting material, second, upon the temperature of conversion and third, upon the time. These three factors can be changed so that innumerable modifications of starch can be produced, depending upon the nature of the work for which the product is to be used.

In the conversion of starch by this previously outlined treatment, we have one important difference other than physical characteristics from thick boiling starch, and that is that the conversion renders a certain portion of the starch granule soluble in water. Solubles of these products will range anywhere from near zero to 99 per cent, and one reason gums have much lower viscosities than thick boiling starches is due to the presence of soluble material which does not add to the viscosity. The most important reason, however, why these gums have special characteristics such as lower viscosity, flow, smoothness, tackiness and other properties which one looks for in a gum or dextrine, is due to the physical changes produced in the starch granule by the conversion.

If we take these products, suspend them in water the same as we did thick boiling starch and gradually increase the temperature, we find that there is no set gelatinization point such as there is for starch. For some of the products, water at room temperature is sufficient to gelatinize them, and as we cook them we would find, depending upon the nature of the gum or dextrine, that their initial gelatinization might take place at any point on the temperature scale.

Because of the treatment the starch granule has received, we find when cooking gums or dextrines that they do not absorb water and swell, such as thick boiling starch does, but due to the weakening of the A-Amylose, they crack and break up into small fragments. If one were to observe this on a hot stage microscope, we would note that the exterior of the granule would, apparently, flake off in layers similar to taking off the layers of skin on an onion, and that if heating and agitation is continued, that these flake-like particles would in turn break up into smaller fragments. This presents an entirely different physical structure in the paste than with thick boiling starch, for here we have the water of the paste held in a very fine interlocking mass composed of the insoluble portions of the granule of gum, and in addition, we have dissolved in the water the part of the gum which has been rendered soluble by conversion.

In view of what has just been said, suppose we were to take a straight starch paste, add to it dyestuffs and the necessary chemicals, print it and then examine what we have. We would find that this paste would have several outstanding good points about it, but would also have some very bad points. The first thing that we would probably encounter would be that the printer would come to us and say he could not print such a color paste, and if asked why he would say it was too "short" and would show a tendency to break up into lumps in the color box. Also he would fear scratches and streaks due to the fact that the paste had no "cushion" and that the doctor blade would be working so close against the roller that there was no thin lubricating film underneath to soften the effect of the steel blade on the copper. Further than that, if he were printing a fine line or fine detail, he would complain about the raggedness of his line and about the imperfection of the detail due to the pulling out or uneven deposition of the starch paste. When the cloth got to the soapers we would find that it would be very difficult to wash out the paste and the finishing superintendent would probably be much up in arms over the difficulties he would encounter in softening and obtaining an even finish.

However, we would find some advantages due to the use of the starch paste. We would find that we were obtaining a very high color yield with consequent economy in the use of color, and I would like to pause here a moment to refer to the original starch paste to find out why this is. If you remember, we likened the starch paste to a porous structure containing fairly large open spaces in which water was held between the granules, and the granules touching each other made up the solid structure. In making up the printing paste we would be dispersing our dyestuff either in truly soluble form or in molecular aggregates in the water held in these large open spaces. If you will allow me to compare the cloth to be printed to an absorbent blotting paper, when the thin film of paste is spread on the surface of this paper, the water held in the open spaces containing the dyestuff, by capillary action would be drawn down into the fibers. Because of the large size of the swollen starch granules, relatively few of them would penetrate far below the surface of the cloth, but would remain on the outside. This condition allows for mass penetration of the dyestuff without any interference due to starch granules getting on or around the fibers and decreasing their absorbing power. Another reason for good color value is the ratio of dyestuff to starch. Due to the high viscosity of starch, comparatively little of it is needed to make a paste, having sufficient body to be printed, so therefore the number of starch granules present is small. There is one disadvantage, however, which is obvious, and that is that in printing in such a

way with straight starch, even the absorbed water and dye would not penetrate very far and the printing would of necessity be a surface print with little depth to the shade. After the starch film was dried out over the cans and the cloth came to the soapers, we would find the dehydrated granules would not absorb water readily, and for this reason they would be very difficult to wash off the cloth unless given a long time in the soapers, thus giving the granules a chance to absorb water and become loosened from the cloth.

Now let us assume that we are going to print with a straight gum. This immediately introduces the question as to what gum and what type of gum to use, and here we have an innumerable number of choices that we can make. In general, low converted gums still bear a marked relationship to the original starch in that they are apt to be somewhat short and also difficult to wash out. For the purpose of contrast, let us assume that we pick out a fairly high soluble one, quite different in characteristics from starch. In order to make a paste with sufficient body to print, we find that we have to use some three or four times as much dry substance as we would when using starch, which greatly increases the cost of the thickening medium. On examination of the paste, however, we find that we have a long free-flowing syrupy thickener which when put into the print machine will roll up under the doctor blade, gives a good "cushion" between the blade and the roller, will stick into engraving and if not too "tacky" will not stick in too much but will pull out when the cloth is passed against the roll, giving a sharp regular line and a clearcut and clean detail. When the cloth is ready for the soaper we find that the thickener is easily washed out and a soft piece of cloth is the result.

If we were to take the same amount of dyestuff, however, as used with the starch paste and print it on the same pattern under the same conditions, we would find that when using a straight gum that the amount of color left on the cloth after soaping would be very much less than when using the starch paste. This coupled with the initial cost of the gum thickener would give our printer some reason for concern. Let us see here again why it is that we do not get as high a color yield as with starch. Again I must refer to our previous remarks concerning the type of paste produced when a gum is cooked. The paste contains the soluble portions of the gum and a very intimate mixture of finely divided insoluble particles. When the dyestuff is added we find that we have no such open structure in which the dyestuff can be retained in the spaces between granules as we had with a starch paste, but what we do have is a homogeneous mixture of the dyestuff, the soluble gum and the finely divided insoluble particles. When this is applied to the cloth, the soluble portions of the gum are absorbed by the same *capillary* action as in the case of the starch paste, into the cloth. The insoluble portions of the gum, because they are so finely divided, will also be absorbed and will penetrate into the cloth. Therefore, around each fiber we have a coating which tends to prevent the dyestuff getting to the fiber as well as it helped to carry the dyestuff to the fiber. Consequently, much of the dye applied to the cloth is kept away from the cellulose fibers by the interference of the insoluble and soluble portions of the thickener. Also, the ratio of inert material or "thickener" to the amount of dyestuff present is high due to the necessity of using a large quantity of gum in order to get sufficient body to print. However, due to penetration of the thickeners we find that the shades produced have depth to them and that the cloth is well impregnated from face to back with dyestuff.

What we all know and what we all practice in printing is to go to neither of the two extremes just outlined, but we attempt to effect a compromise between the valuable characteristics of thick boiling starch and the valuable characteristics of a high soluble gum with the elimination of as many of the bad points of these two materials as can be done with efficiency. In other words, any printing thickener is a compromise between color value, printability, and by that I mean workability in the machines, penetration, and washability, and we are all striving to effect the best compromise possible. The present tendency in printing gums is to attempt to develop a little more scientifically than in the past, gums of low dry substance which will have the maximum of good points of the two extremes we have just discussed, and the minimum of bad ones.

Before I close I might mention briefly the influence of some of the chemicals necessary to effect proper printing of various types of dyestuffs. In the case of vat colors where the dyestuff is merely a suspension of some molecular aggregates and is printed with carbonate and hydro, the common practice is to cook the thickener with the alkali. The alkali, of course, exercises a profound modifying influence upon the thickener and very often no relationship between straight paste viscosity and viscosity when cooked with alkali can be determined without actual trial. With some products, a marked thinning takes place, while with others, jelling or thickening is apt to occur. In the case of Rapidogen colors where caustic soda is used, the thickeners may be modified greatly by the action of the caustic which has a tendency to gelatinize the thickener in the cold, and will usually cause a thinning. No doubt some of you have had this experience where you have held over a tub of Rapidogen color for several days and found that the consistency had changed from the time it was freshly made. Cellulose products are very sensitive to oxidizing materials such as are used in the steaming method of printing indigosols and here again changes may be caused in the paste when it has been standing for some

length of time. In the selection or development of a proper printing medium, all of these points should be kept in mind, for otherwise much of the efficiency will be lost, and uneconomical processing will result. I have touched but briefly upon the effects of various chemicals on starch and gum pastes, first because I do not know much about these effects, except from a practical standpoint, and second, the discussion of chemical and physical changes produced by the action of alkalis, acids, oxidizing agents and salts, could well be made the subject of a separate paper.

CONCLUSION

Let us recapitulate briefly the chief points that have been presented.

1—The structure of a thick boiling starch paste consists of relatively large open spaces between large swollen granules of starch.

2—A paste made entirely from gum consists of ultramicroscopic particles of gum intimately dispersed in the liquid medium, which also contain the solubles formed from the conversion.

3—Printing pastes made from thick boiling starch contain the dyestuff in spaces where it is kept separate from the thickening medium.

4—Printing pastes made from a medium or high soluble gum form an intimate mixture between the dyestuff and thickening agent.

5—Pastes made from thick boiling starch, because of their low dry substance and large open spaces, tend to release the dyestuff freely, but do not penetrate readily; neither do they possess good flow.

6—Pastes made from gums alone, because of their high dry substance and intimate mixture with the dyestuff, do not tend to release the dyestuff readily but penetrate well and possess good flow.

ANNUAL OUTING, RHODE ISLAND SECTION

THE fourth annual outing of the R. I. Section was held on June 14th, 1935, at the Warwick Country Club, with approximately one hundred members and guests present. Herbert Kuhl, as chairman of the Outing Committee, was responsible for a well-planned day in which golf, tennis and swimming were enjoyed by many. The highly prized golf trophy was won by Delbert F. Gifford with a low gross score of 83. Due to lack of competition, no tennis match was played.

The day was topped with an excellent dinner served at the club house, after which a short business meeting was held.

The meeting was brought to order by Chairman John G. Masson. The presentation of prizes was made by Herbert Kuhl. The following officers were elected to serve for the coming year:

Chairman, John G. Masson; *Treasurer,* Robert R. Farwell; *Secretary,* Raymond A. Pingree; *Councilor,* Ben Verity; *Sectional Committee,* Peter J. Ariente, Richard B. Earle, Richard Haworth and Philip C. Putnam.

The meeting was adjourned at approximately 10:30 P. M.

Respectfully submitted,

RAYMOND A. PINGREE,
Secretary.

ANNUAL OUTING, NORTHERN NEW ENGLAND SECTION

THE regular Annual Outing of the Northern New England Section was held Friday, June 7th, at the Vesper Country Club, Lowell, Mass. Dubious weather in the morning gave way about mid-day to excellent outing skies and the golfers and tennis artists made the most of it. Dean Symmes went on his usual hunting expedition with the movie camera and few escaped his accurate shooting.

Following the usual dinner, the Treasurer's report was read, showing a small balance in the treasury, and was accepted. Mike Lane then gave the Teller's report of the customary spirited election returns which showed the officers for the coming year to be as follows:

Chairman, Roland E. Derby; *Secretary,* John N. Dalton; *Treasurer,* John H. Grady; *Sectional Committee for Two Years,* Kenneth H. Barnard and Dean W. Symmes; *Sectional Committee for One Year,* Clarence L. Nutting; *Representative to National Council,* Roland E. Derby; *Representative to National Nominating Committee,* Roland E. Derby.

The meeting was then turned over to the Outing Committee Chairman Joseph Bryant, who briefly reported that his very efficient committee was glad to be able to report a substantial profit to the Section from the outing. Phillips Graham then awarded the prizes as follows:

Golf

Members' Prizes

Low gross—Hugh Ross 83
Low net—Walter James 64
Second Net—Mike Lane 71

Guest Prizes

Low gross—Roy Buckler 80
Low net—Leo Van Koert 67
Second net—Frank Benvie 71
Long drive ..... J. A. Bryant, Jr.
Putting ..... Milton Washburn, Lem Craft

Tennis

Doubles ..... John Healy and Chas. Schmidt
Singles ..... Allan Burke

Quoits

Team prize—Doubles ..... John Burnett, W. W. Pennock
Singles ..... Thomas Philips

(Continued on page 401)

Proceedings of the American Association of Textile Chemists and Colorists

Starches and Starch Products

Their Application to Cotton Textiles*

By JAS. W. STALLINGS†

STARCH in general is a white, odorless, tasteless material represented chemically by the empirical formula $(C_6H_{10}O_5)$ taken "n" times and falling into the class of carbohydrates. It occurs abundantly in the plant kingdom in seeds, bulbs and tubers in varying percentages.

The starches more commonly used in warp slashing are corn and potato. For finishing, corn, potato, wheat, tapioca, sago and rice, as well as conversion products of any of the aforenamed starches.

To the average individual samples representing all of the known starches may look little or no different to the unaided eye. Microscopically, chemically and physically there are great differences, and to observe carefully their individual looks, behavior, etc., is like making a trip through an interesting country, and will convince anyone that it is impossible to get the proper work with any one starch throughout the cotton textile field. Of course, there are cases where sacrifices have been made, and quality overlooked.

Now briefly I will discuss a few microscopic characteristics of the starches more commonly used in daily practice, namely corn, potato, wheat, tapioca, sago and rice.

Corn starch granules appear microscopically in a polyhedral form, however there are some small practically cylindrical granules. The hilium, that is, the nucleus around which the granule has developed, is usually star shaped and centrally located. Corn granules have been measured from 14 to 26 or 28 microns, and depending somewhat on the position of development in the cereal.

Potato starch microscopically appears oval, or somewhat in the shape of an egg; there are, too, small granules quite round. The hilium is usually found at the smaller end of the granule from whence concentric rings covering the granule seem to have their beginning. The size of the granules vary considerably, and have been measured from 15 to 100 microns, depending upon their maturity.

Wheat starch granules microscopically appear practically cylindrical and varying considerably in size. The hilium while centric is seldom distinct. The size of the granules vary usually from 20 to 40 microns in diameter.

Microscopically granules of tapioca appear fairly round, however, some have a flattened side and others slightly turn-shaped or *hemispherical*. The granules range from 5 to 30 microns in size. The hilium may represent itself in the star-shaped form, or in the form of a crack.

Sago flour microscopically appears oval, or better in the shape of an Irish potato, others urn-shaped, and small granules practically round. The hilium, quite distinct, is usually observed at the rounded end of the granule. The granules on an average measure 10 to 60 microns.

Rice starch appears microscopically similar to corn, only considerably smaller in size. The hilium while centric is not always noticeable. The granules range from 3 to 5 or 7 microns.

Starches obtained from cereals such as corn, wheat and rice are known as cereal starches. Those from roots or tubers such as tapioca and potato are known as root starches. Sago while neither cereal nor root is usually classed according to its behavior and similarity with the root starches.

The thick boiling starches represent the starch as it is obtained from the cereal or root at the completion of Nature's work. Such starches when cooked yield the maximum viscosity of each variety. Modifications from this form by various processes give us thin boiling, modified starches, dextrines, glucose, dextrose, etc. Root starches are much more sensitive to processing than are the cereal starches, so naturally we do not find the variety of conversion products in potato, tapioca and sago as we do in the most common cereal starch, which is corn.

The modification of corn starch is usually carried out in one of three ways, namely: (1) the processing with acid in water suspension; (2) the processing dry with a small percentage of acid, plus heat; (3) the processing with heat alone or roasting. The wet treatment with acid gives thin boiling starches with varied viscosities, farther conversions to dextrine, and still farther to glucose, etc. The dry acid method plus heat gives thin boiling starches, white and canary dextrines. The roasting method gives gums of low, or high solubility. The degree of conversion in any of the above methods being dependent upon time, temperature and percentage of acid used.

Corn starch is the only starch marketed with such variations of degree of conversion and commonly known as "fluidity," which eventually means little or nothing other

*Presented at meeting, Southeastern Section, April 27, 1935.
†Chemist, Stein, Hall & Co., Inc.

than a simple classification. The test is conducted by treating a sample of the starch with a caustic soda solution causing a cold rupture of the granules, giving body to the solution. The flow is timed through a calibrated funnel, and the so-called "fluidity" thus determined.

The viscosity of a starch on the other hand is determined by cooking a given sample of starch for a definite period of time in a given volume of water with stirring. The mix is then placed in the viscometer and its exact viscosity determined. Practically this tells one what to expect from a starch and conforms closely to plant procedure, whereas the "fluidity" determination is a process foreign to plant processing. It is quite possible to have a starch with a certain "fluidity" before cooking and a quite higher fluidity after cooking, unless the starch has been properly processed to prevent such changes. To simply change from a "fluidity" reading to a viscosity reading does not mean that the starch will be uniform in cooking, but it does mean that starches marketed by viscosity readings tell one what to expect in the cooking kettle.

Thin boiling starches in respect to warp sizing, I believe all will agree, have proven advantageous in shorter cooking time, added smoothness, and better penetration. Some wonder why it is necessary to cook starch so long, and why you don't make a starch to cook completely in 20 to 30 minutes. This can be done, but at what cost? To sacrifice approximately all of the good weaving qualities this can be done. Further now, may I ask what does cooking time amount to as compared with the good weaving of a properly sized warp, which will be on the loom several weeks? To lower the cooking time means one of two things—to lower the concentration, or to use the regular amount of a "quick-cooker" which has been converted until it really cannot be called starch. Such starches below the average thin-boiling range are "quick-cookers," and give ample weight and penetration, but little or no size film, which is so vitally essential to good weaving.

Potato, tapioca and sago starches are usually cooked in the natural form, or modified to some extent in the kettle by chemical or enzymic means, to suit an individual plant's conditions.

Along with any of the starches used in warp sizing, there is in most cases the addition of some fat, gum, and sometimes a wax. The fat and wax gives the warp yarn pliability, smoothness and lubrication, while the gum acts as a binding agent, toughens the film and gives added strength. Many mills use what is known as "Compound," and this material usually comprises these ingredients in their proper proportions.

Last, but not least of all in connection with cooking of starches for slashing, is a reliable water supply. Water for this purpose should approach distilled water purity as nearly as possible. Often times so long as water is fairly clear it is fine. This is quite an hallucination, optically and chemically speaking. Two instances within the past few months where the starch was "going to water" were problems for our technical service department. In both cases it was not starch troubles, but water contaminated with traces of heavy chemicals. The water, while practically clear, contained sufficient chemicals to destroy the body of the starch completely. The careful control of the water supply is very important, and should in no instance be overlooked.

The next important use of starch and starch products is in the finishing of piece goods. The goods to be finished may be bleached, semi-bleached, or from the loom. Materials from the loom are mostly colored goods such as denims, chambrays, tickings, etc. Such goods are usually weighted with a mixture of starch, sulfonated tallow or oil, and dextrine, glucose or some far converted starch product. Epsom salt has been used in some cases, but usually with undesirable results, resulting in a harsh finish, and a breaking out of the softening agents used.

For sanforized goods, usually specially converted starches of controlled solubility, plus a liberal quantity of sulfonated olive or castor oil to insure smoothness and proper wetting out is used, as in the case of denims. Where additional weight is not wanted, usually the warp size provides ample stiffness, and to wet out in a sulfonated oil solution and dry, then sanforize gives an excellent finish.

Some very nice work is now being done in recriprocal weighting of white and dyed goods, which show unusual losses in finishing processes. It is possible to add as much as 100 points and have all the apparent qualities of a 100 per cent cotton fabric. In case of the dyed fabrics of this type, weighting and dyeing is usually combined in one operation.

In the finishing of white goods, it is of greatest importance to have a good bleach first of all. Both peroxide and hypochlorite solutions give excellent whites when handled properly, and this is another extremely important place to have pure water.

The selectivity of one starch over another, or one dextrine over another, in finishing is quite important. On heavy ducks, twills and similar goods there is not the careful scrutiny of characteristics of a finish as on broadcloths, organdies, and specials.

The use of one starch and one dextrine throughout the finishing plant is quite impossible, unless the only quality wanted is stiffness. It is quite true, however, that the number of starches used in finishing formulae have been minimized considerably. Different starches have characteristics, as well as similarities, each to each, but no two coincide altogether in their working qualities. The dextrines, too, follow with some of the characteristics of the parent product.

In finishing, the two most important essentials of the

size mix are, namely: (1) an adhesive, or stiffener; (2) a softener or lubricant. Sometimes a hygroscopic agent is added, but this is seldom essential. Ingredients used in finishing may be classified as follows:

1. *Starches and Gums*: Corn, potato, wheat, tapioca and dextrines for stiffening, and locust bean, karaya and tragacanth gums for binding. The locust bean gum is decidedly the best binder.

2. *Softening Materials*: Sulfonated tallow, sulfonated oils and sulfonated fatty alcohols. The oils consisting of castor, olive, or olive-mineral mixtures.

3. *Fillers*: Talc, china clay, lithopone, etc.

4. *Weighters*: Organic materials such as glucose, or other specially prepared highly converted starch products which add weight without stiffening. Inorganic material such as sodium chloride, sodium or magnesium sulfate, natural clays, etc.

For any finish the amount of starches, dextrines, weighters, fillers, or softeners used in a given mix should be carefully observed. Such careful observation not only results in better finishing, but sound economy as well. As an example: if we have a material that must be weighted a few points and finished with a supple hand, it would be quite false economy to weight it with a thick boiling starch, plus a quantity of softening agent, when a dextrine plus a minimum amount of softener would give the same finish. The competition in finishing nowadays makes it quite necessary to make a thorough check of all finishes. Some plants at present use the same old antiquated formulae used over a period of years, and rightly, are back in the horse and buggy age. Whether competition on a particular finish is quite keen or not, an investigative analysis should be made from time to time and proper substitutions made to get a balanced formula. New finishes as well as old sometimes require new products. There are quite a number of new starch products, as well as old, that are not familiar to every finisher, so this should rightfully necessitate a close contact of the finisher with the starch manufacturer, as well as the starch manufacturer with the finisher.

Finally the objects in finishing are what might be termed "whimsical," and oftentimes to produce the exact degree of flexibility or stiffness, smoothness or harshness, paperiness or fullness, or a combination of all the characteristics which is the impossible, in some of the combinations practically all starches and their conversion products in one single mix have been known to be used.

In conclusion, I wish to state that it is my firm belief that within the next five to ten years there will be well towards the same attention given to starch, starch products in research, plant control, etc., as is now given to the art of dyeing. Plants cannot get along with hit and miss dyeing. If goods are dyed off shade with fast colors the replacement usually means new cloth. The loophole in finishing lies in the fact that goods can be desized and refinished properly, but nevertheless this is quite costly, and whether it shows up in green or blue, it sometimes shows up in the red.

ANNUAL OUTING, NORTHERN NEW ENGLAND SECTION

(Continued from page 398)

Golf Set Raffle

Archie K. Innes

The several prizes were generously donated by firms represented in the Sectional membership, for which Mr. Bryant expressed the appreciation of the Outing Committee.

The attendance at dinner of 129 is the largest outing turn out in a number of years and reflects improved conditions and a steadily increasing membership.

The distribution of the prizes concluded the festivities, and all departed feeling grateful to the Committee for a very successful and enjoyable outing.

The Outing Committee

J. A. Bryant, Chairman, R. E. Derby (Chairman of Section, Ex Officio), E. Weber, M. J. Lane, H. F. Finlay, M. P. Graham, H. P. Selya, J. N. Dalton

Respectfully submitted,

CLARENCE L. NUTTING,
Secretary.

MEETING OF THE PIEDMONT SECTION

A MEETING of the Piedmont Section was held in the Poinsett Hotel, Greenville, S. C., on May 4th, 1935. Paul Haddock of Charlotte, N. C., presided, and opened the meeting with the following remarks:

"Gentlemen, as you all know this is the Spring Meeting of the Piedmont Section of the American Association of Textile Chemists and Colorists. This Association was formed in 1921. At the beginning of this season the Section had ninety-five paying members and today there are one hundred and forty. Everybody is working hard trying to bring this before the end of the year to a much larger number. Our first paper this afternoon will be by Hill Zahn, Southern District Manager of H. W. Butterworth & Sons Co., Charlotte, North Carolina."

Following were other papers, by Raphael E. Rupp, Chief Chemist of the Pacific Mills, in Lyman, S. C., on "Chemistry as Applied to a Textile Plant Instead of Textile Products"; and by A. E. Sampson, Director of the Dye Application Laboratories of the Calco Chemical Co., Bound Brook, N. J., on, "Some New Developments in Vat Colors, with New Methods of Printing and Dyeing."

Respectfully submitted,

THOMAS R. SMITH, *Secretary.*

Proceedings of the American Association of Textile Chemists and Colorists

The Application of Salt Brine

to Textile Processes*

By ROBT. V. IRWIN†

BEFORE I take up the main subject of this paper, i.e., the lixate process for making brine, it may be well to tell you briefly something about the production of salt.

Before modern methods of production made salt available to everyone, men had to fight, open new trade routes and make new discoveries to get it. Today the drama of salt centers in its production. Vast mines are dug, deep wells drilled, strange new machines invented—all to make sure that salt is produced in quantity and quality to suit the need of every user.

Salt affects the daily life of everyone. It adds to human happiness in many ways besides the stark necessity of salt to maintain life. Salt has a personal significance for you whether you use it by the ton in industry or by the pinch at home. The shoes and clothes you wear, the paper that brings the morning news, the bacon sizzling in the skillet, —these and many more products of industry are made possible, made better or at lower cost by salt.

There are two essential kinds of salt, evaporated and mined. Evaporated salt is produced from brine. There are two kinds of brine, surface brine and brine from wells. Surface brine comes from sea water or salt lakes. Brine from wells is either natural or made artificially by pumping water into wells drilled into deposits of rock salt. Salt from surface brine is most generally prepared by natural evaporation in the sun's rays. Salt from brine wells is produced by various methods of artificial evaporation. Two evaporating methods are used—the vacuum method and the grainer method. The vacuum method produces salt in hermetically sealed vacuum pans in the form of minute crystal-like cubes. This type of salt has been used in textile dyeing where any insoluble matter found in mined salt is objectionable. The same type of salt is used for table salt.

The other method for producing evaporated salt is accomplished by what we call the grainer system. This method produces salt in open grainer pans at atmospheric pressure. This type of salt is produced for the many industrial users who require or prefer a flake salt.

Mined salt, or rock salt, may be produced from the same deposit as the evaporated salt. In one process water dissolves the salt in a well to produce brine; in the other, the solid rock salt is mined more or less like coal is mined. Rock salt comes from underground in large lumps, which are crushed, screened, and graded to the various commercial sizes needed. I won't attempt in this paper to go into detail as to how the many grades and sizes of salt are produced,—that would embrace a paper by itself.

In textile dyeing, we have as you all know, many classes, such as raw stock, package, beam, chain, piece, jig, continuous, and what have you, but after all there are only two—one where the dye solution is in circulation and the other where it is still. I believe you gentlemen will agree with me on that point. Where the solution is still and salt is added to exhaust the dye, it may be possible, and it evidently is for many dyers are doing it, to get by with a mined salt, for in this case the insolubles found in all mined salt, consisting mostly of a fine silica sand, will precipitate out and drop to the bottom of the dye vat or machine, but where the dye is circulating through the raw cotton, yarn or cloth—there the cloth or yarn acts as a filter and catches these fine particles and you all know what the result is.

Hosiery dyeing in a rotary machine must be put under the still dye classification and if you attempt to use a mined salt in this dye bath, I promise that you will have plenty of grief, where the yarn is at all delicate—such as silk or rayon. I have known cases where the hose would show torn places and in tracing them down they were found to be caused by the insoluble sand. After a while the machine itself starts giving trouble and you send it back to the manufacturer. Let me quote from a letter received from a manufacturer of this type of equipment: "A thing which we have found in dye houses using our rotary hosiery machines is an accumulation of sand or other insoluble matter in the bottom of the dyeing machine tanks. I have seen this crust one-half inch thick on machines which have been sent into us for repairs. Not only that but should there be sand or finely divided abrasive material of any nature in the average mined salt, this substance will get into the bearings of any machine and certainly do them no good." This all resolves itself into the question as to the proper kind of salt to use as an exhausting agent and I don't hesitate to tell you gentlemen that unless you use some means of removing the

*Presented at meeting, Southeastern Section, April 27, 1935.
†Technical Representative of the International Salt Co., Inc.

insolubles from the mined salt, then by all means use evaporated. The cost may be greater to start with but it will pay you in the long run to use it.

Now I am going to contradict myself and tell you to use a mined salt. I have had a lot of people tell me that it must be hard for me to talk rock salt after advocating evaporated for so long, but there is a reason for it and that is because we can now offer you a simple equipment known as the "Lixate Process." The name lixate is derived from the term "Lixiviation," which means the separation of soluble and insoluble material by dissolving and filtration. This dissolver has that rarest of all combinations—extreme simplicity and 100 per cent efficiency. It produces brine of practically 100 per cent saturation and clarity out of the mined salt. One hundred per cent saturated brine is not obtainable in ordinary plant operation with stirring type devices whether manual or machine operated. With this system it is made automatically. What happens? Briefly it is that we get a maximum salt area exposed to the dissolving water, the dissolver is filled solidly with salt from top to bottom. There is no way on earth to get more salt area than this in a given space. Water circulates downward through the salt under the influence of the only force that doesn't cost money—the force of gravity. The turns, constriction and enlargements in the flow channels break up and change the brine films on the salt crystals more effectively than any mechanical method known. Complete saturation takes place with unbelievable rapidity under these ideal conditions of maximum salt area and maximum film change.

In filtration of the brine the salt itself and the fine insoluble material is used as the filtering medium. In all filters, liquid passes through a porous medium, usually a cloth fabric which holds back the solid particles suspended in the liquid. Now this fabric is seldom the true filter medium, as the average particle is usually much finer than the average opening between fibers. The real filter meduim is a layer of solid particles, caught in the fabric surface. The first effluent will always run cloudy for an instant till this layer is formed. This filter process has been applied to the lixate process. Since fabric does not filter why use it? Since the fine particles are the real medium, let the undissolved salt itself form the filter bed and this is what we do: After about 20 tons of salt have been dissolved, this depending upon how dirty the salt was to start with, the pores of the undissolved salt become filled up with the insolubles it has removed, so that the flow of brine is retarded and starts getting cloudy, then it becomes necessary to clean the dissolver and flush out the insoluble matter and this takes about five minutes with ordinary water pressure.

So much for the description of what takes place in the dissolver. We know at a predetermined rate of flow the brine effluent will always be 100 per cent fully saturated, if you want to test the accuracy of a salometer, try it in this brine (if it doesn't register 100° then I will guarantee that the salometer is not correct). Now the thing you gentlemen are interested in is the application of brine to textile dyeing. I think in all my experience that I only found one dye plant using a brine instead of a dry salt, before this lixate process was introduced; now you will find several. To begin with, why do you use salt in a dye bath? There is very little written in textbooks on this subject. The common expression or explanation is that it exhausts the dye. The simplest explanation I have heard yet is that salt is more hygroscopic than any of the dyestuffs employed. Having this great tendency to unite with water, salt seems to displace molecules of dyestuff, which have less tendency to stay in solution, that is, dyes are more insoluble in brine than in water. This tends to force them onto the material being dyed. In other words, the salt just seems to drive the dyestuff out of solution and since there is a tendency of the proper dyestuff to unite with any definite material, for which it is being used, the dyestuff naturally goes into the material (this is about the only place for it to go). The action, if you please, is entirely mechanical; no chemical action takes place. Another way of stating this is that dyes and salt cannot occupy the same space in solution at the same time and the salt drives out the dye.

Now in any open type of dyeing no problem presented itself at all. At a large mill in Massachusetts we made some very interesting tests with piece dyeing. We found that the finished cloth, using brine, actually handled better; it was softer and more evenly dyed, and absence of shading and salt stains was marked. It is almost impossible to spread dry salt evenly in a dye bath. It is bound to fall in little mounds. Although quickly dissolved, if evaporated salt is used, it has a tendency to adhere to the cloth, resulting in a hard surface. The explanation for this is that some of the crystals never completely dissolve. This adherence causes "salt stains" when the pieces are taken out. As you know when the desired color is obtained, you issue orders to dump the vat, then the cloth is ready to be washed, cold water is run into the vat and salt again poured over the cloth to hold the color in and to wash off the excess dye. This is repeated until samples of the water show clear, then the cloth is taken out, piled on trucks and taken to the dryers, where it waits its turn. It is soaking wet at this point and what happens is that the undissolved salt left on the cloth has a tendency to dissolve and run to the edges. When the cloth is dried out a whiteness along the edges is plainly noticeable and the cloth is sent back to be redyed. This all raises the cost of operation in your department. With a saturated brine an even distribution is assured over the cloth and we were able to eliminate salt stains and white edges entirely.

When we came to pressure type dyeing, such as raw

stock and package, everybody threw up his hands and said it couldn't be done. They wanted to know what we were going to do with excess liquor and how we were to control the ratio between the liquids and solids. Well instead of being discouraged, I went to an old German dyer friend of mine, told him the story, and when I told what all the experts said about the impossibility of using brine in a pressure vat, he got mad and said, "By Gott, we can do it," and so we got our heads together (mostly his) and went to work. He was using a fine grade of evaporated salt, so we made up a saturated solution of brine, then rigged up a barrel alongside the expansion tank and ran a pipe line with a valve in it between the two, then we took a line off the vent pipe also with a valve in it and ran it into the top of the barrel. We made the test with 1,000 pounds of stock using a sulfur black dye, measured out the equivalent amount of brine corresponding to the amount of salt required and put it in the barrel. Both the valves mentioned above were closed, for as you know, salt is not added until the cotton has been in contact with the dyestuff for at least a half an hour. When the time came to add salt we opened the valves, let the dye liquor circulate through the brine in the barrel. Then it was brought back through the expansion tank by the pump the same as it always had been and instead of causing any overflowing in the expansion tank there was a marked drop in the liquid level as soon as the brine hit the cotton, because the salt pulled the excess moisture into the cotton. You all know how salt will attract moisture. We are using it now on dirt roads to keep the dirt down, using this same principle. As far as we could see there was no marked improvement in the dyed stock. I really didn't expect one; all I wanted to know was whether or not we could use the brine and obtain the same results. So now all that is necessary is to add a brine tank alongside the expansion tank, but I might tell you in doing this to use the same size outlet piping from this tank as the suction line from the expansion tank, and have the interconnecting piping enter the expansion tank slightly above the suction head.

They use a large amount of salt at the mill where we made this experiment, and by adopting this system will save the difference between the price of evaporated and mined salt, which will amount to a considerable saving, and that is what we are looking for in these days and times. When you stop to think of what the mills have to pay for cotton and then consider the number of operations it goes through before it reaches the finished product, and then figure out what they get for that finished product, I tell you, gentlemen, it behooves you to keep the cost of operating your department down as low as possible without sacrificing quality.

FELLOWSHIP

Full-Time—July 1935-36

(As Research Assistant to the Sub-Committee on Mercerization Research, American Association of Textile Chemists and Colorists.)

REQUIREMENTS ASKED OF THE APPLICANT

1. Graduate with B.S. degree in Textile Chemistry, Textile Engineering with sufficient chemical study, or Chemical Engineering. Applicant with M.S. degree is preferred though not essential to making application.
2. Applicant to have had at least one year or more of practical experience in textile chemical laboratory and plant work where the mercerization of cotton yarns or piece-goods was being carried through both experimentally and on regular production.
3. In lieu of option No. 2, the applicant may substitute two years or more of graduate and research work on some line of textile chemical or engineering study. (Copy of such type of work carried out or assisted on should accompany application.)
4. It is desired of the applicant that he be able to read Technical German for bibliographical and research purposes.
5. Give name, and other technical experience if any, names of firms connected with and the head officials of same as well as officials under whom you worked directly.

   This study is financed by this Association and the successful applicant will receive between $75.00 to $90.00 monthly on a 12-month basis. Final rating will be according to training and experience.
6. Make application on typed sheet and write a short letter in long-hand as to your particular interest in textile chemical research and what you feel it has to offer in the future.
7. Send application with self-addressed envelope; when final decision is made, you will be promptly notified.

CHARLES B. ORDWAY, *Chairman,*
Sub-Committee on Mercerization,
P. O. Box 62, Auburn, Alabama.

AMERICAN
DYESTUFF
REPORTER

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ON GETTING ALONG WITH PEOPLE—II

(Continued from last issue)

Obtaining Approval for a Project

THE most important point in getting approval for a new project is to arouse a real interest in it and a real desire for its success rather than a mere O.K. for a certain amount of work. The project may be anything from a proposed new product or style, or a year's research program to a simple little mill experiment. In the first case it may be most important to have the approval of a high officer or executive of your organization, and in the last it may be more important to arouse the interest of some foreman in the plant.

We are going to talk about ideas of your own which you believe in and wish to see tried out, but there are so many kinds of possible situations that one cannot offer any specific set of rules. We can, however, anticipate a few of the kinds of problems that may arise.

Our subject is not like a matter of scientific fact; and it is easy to dogmatize on the basis of mere opinion. However, judging by my own experience and that of others there are a few rather definite policies in presenting a proposition for experiment or more extended research which are most likely to lead to the desired action.

Your approach will naturally vary somewhat depending upon whether you are seeking to obtain the approval of a general manager, a superintendent or a foreman; or whether you are trying to arouse the helpful interest of an operator in the mill.

First of all be as sure as possible that your proposition is worth while and that it has been checked as far as it can be in the laboratory or in any other appropriate way. If you prove to have been right it does not matter greatly just how you put the thing across in the first place. But, if you prove to have been wrong it is best to have a well worked out case and clearly to have been mistaken, rather than to be open to the accusation of having "gone off half cocked," or having tried to "put something over."

Prepare your approach according to the individual. A plausible sales talk may be all that is needed with some men who are interested only in results and profits, if you can describe your project in such terms. But, there are those, some of them rather high in authority, who will question details and raise all sorts of objections; and there are those who are just naturally on the contrary side and whose arguments have to be met. In contrast are other men who will be really interested but will think about ways and means and raise various questions from the practical point of view.

Just as far as possible offer a definite or a complete detailed program proposal rather than a general plan. According to authority you will be ten times as likely to succeed.

Don't make the other fellow think too much. People do not like to think, although they like to think that they do. Also, avoid making the other man think out your case because it wastes time for both of you. However, you cannot always do that because some men seem to have to start at the bottom and think everything through in their own way. There are plenty of others that do not want to bother to think.

Unless you know your man, then, do not make him think but carry as much as possible of your point by pictures, diagrams or samples. A sample sometimes has a wonderful effect although it may actually mean next to nothing. It must look good—be smooth, level dyed, not tangled, neatly mounted, clean or whatever is required to make a good impression. You frequently have trouble in the laboratory in making a sample look as well as a finished manufactured article but it will be judged by such goods and must not leave too much to the imagination.

Sometimes busy men show a surprising interest in some little mechanical device or a chart, and that may give you something upon which to hang your discussion. Arousing such interest or curiosity may give you the best opportunity to tell your story. For example, this has been done by showing laboratory dyeings which bring out some unexpected peculiarity or result, and naturally lead up to trying the same thing on a larger scale in the dyehouse.

In general, put your case in terms of the other man's experience, or in terms of things in which he is interested and which he can easily understand. You should assume that the other fellow does not know much about the matter in hand, but present your points as though they are familiar and you are merely giving them all in order to make a complete logical story.

Try to combine any new ideas with something that is already familiar. The object of all this is to get someone else interested in something which you wish to do, or to have done—to make him want it, too.

Sometimes an objective can be gained by presenting it backwards, "You wouldn't want so and so done, would

you?" The contrary type of person may decide that he does want it if you imply that you do not.

There are other recognized ways of getting favorable responses which I have not used so much. For example, to exalt the ego, i.e., giving the other fellow a better opinion of himself may work, but it may not be so good if you are to have very much subsequent contact with him.

Sometimes asking advice or the right kind of a favor will promote a friendly feeling and prove to be helpful. Appealing to another's special knowledge is likely to be of mutual advantage.

If there is already no appreciation of the value of intelligently planned mill experiments it may be advisable to try to educate some one higher up in the organization to the necessary interest in such matters and thus create "a friend at court."

In trying to effect useful practical contacts between laboratory and mill one may encounter very evident, prejudiced hostility. There are probably no rules for such cases but they seem to show the need of some plain talk from higher up, or perhaps a change of personnel.

It is sometimes hardest to get the approval of persons of approximately your own rank who may feel obliged to be rather critical, or to show who's who.

Finally, if you find yourself getting into a jam it will likely be best to quietly withdraw, to replan your work and its mode of presentation and to start over again.

(Further comment on this subject will appear in the next issue.)

● BOOK REVIEW

Chemical Guide-Book, 1935, Eleventh Annual Edition, Chemical Markets, Inc., New York. 803 pages, including advertisements.

This book may best be described by the titles of the various parts, of which there are four. Part I—A catalogue of leading chemical firms in the United States with their products alphabetically arranged. Part II—Buying guide and directory of chemical products arranged alphabetically with name and address of sources of supply, the chemical and physical characteristics of each product, grades, containers, shipping regulations, tariff, etc. Part III—Geographical directory of the chemical and allied industries, giving street addresses and telephone numbers. Part IV—Chemical statistics—high-low prices for the years 1933 and 1934 on approximately 1,500 important heavy and fine chemicals, intermediates and allied products. There is also a list of trade associations and technical societies active in the chemical field, including the name and address of the secretary of each. It is interesting to note that this guide-book is considerably larger than the previous edition, there being 108 additional pages, 153 additional chemicals and 160 additional synonyms.

● BRITISH CHEMICAL TRADE

Foreign trade gains made by the British chemical industry in 1934 have been well maintained during the current year, according to C. C. Concannon, Chief of the Commerce Department's Chemical Division.

Exports of British chemicals and allied products during the first four months of 1935 were valued at $39,000,000, an increase of 5 per cent over the corresponding months of the preceding year, and 14 per cent above the first four months of 1933, statistics show.

Imports of chemicals into the United Kingdom, however, during the first four months of 1935 declined 8 per cent to a total value of $31,600,000, compared with the 1934 period, but were 27 per cent higher than for the first four months of 1933, it was stated.

The improvement in export trade was noted generally throughout the various classes of chemicals, and was due chiefly to larger shipments to Empire countries. Exports of caustic soda and sodium carbonates to Argentina, Brazil, Japan, China and to all British countries advanced very substantially and there was a marked increase in exports of creosote oil to the United States. Shipments of medicines, coal-tar dyes and ready-mixed paints to overseas countries were also larger, according to the Commerce Department.

The decline in total chemical and allied product imports was due largely to smaller receipts of Indian shellac. Import items showing advances over the first four months of 1934 included potash, sodium nitrate, and phosphate rock fertilizers and sulfur.

British domestic production of chemicals was approximately 5 per cent greater during the first quarter of 1935, than for the first three months of the preceding year, according to the index of the British Board of Trade.

● NEW COLUMBIA SILK COURSE

Columbia University, Evening Extension, announces the appointment of J. J. Reutlinger of Hatch & Reutlinger, textile specialists of 366 Fifth Avenue, New York, N. Y., as instructor in a new evening course on silks, beginning with the fall semester. This course is scheduled for Tuesday evenings from 7:30 to 9:20 P. M. in Room 410 B, School of Mines, and consists of 15 lectures, one each week. Information of this new course can be obtained from the Bulletin of Information sent on request to prospective students. Other textile courses offered in the fall semester are spinning and weaving of cotton, rayons and woven and printed design for textiles. The director will add more courses as conditions warrant from time to time.

"Marking-Off" in the Print Works*

By W. A. WHYTE

MARKING-OFF may occur in any print works in a number of ways during the processing of the goods. These may be enumerated as follows:

Mark-off during printing by roller, block or screen.

Mark-off during steaming of the goods in the rapid ager, the cottage steamer or the indanthrene steamer.

Mark-off during developing, washing-off and similar wet treatments.

Mark-off during the final drying and finishing processes.

In all these cases the trouble may occur with different groups of coloring matters and it is the writer's intention in the present article to give an outline of the occurrences and how to prevent them.

SOILED BACK-GREYS

In roller printing, marking-off may occur as the result of using dirty back-greys, i.e., greys that have been used more than once. This may happen when printing light patterns especially. The printer, taking into consideration the fact that the pattern is light, decides to use the back-greys a second time (on the reverse side); in most cases of this kind the printer is justified in so doing. Occasionally, a pattern of this type is rather better penetrated than the printer imagines, due perhaps to a softer thickening, the use of more pressure, etc., with the result that a greater proportion of color has penetrated the cloth on to the back-grey than the printer has made allowance for. In a few instances there will even be a small amount of this color forced through on to the other side of the grey and it is this small amount which will give rise to damage in the form of a mark-off. The amount of color in such a case does not necessarily need to be large, for a faint mark-off in a pattern showing a lot of white ground, is just as bad for sales purposes as a more pronounced effect. Such a form of damage is easily noticed by the printer, who can immediately take measures to prevent its continuance, by putting a clean batch of back-greys in place of the dirty ones. The colors which need to be carefully watched in this respect are those that are colorless in their printing pastes. If drying is carried out properly, such colors as the indigosols, rapid fasts and aniline black will show very little development after drying, and if penetration of the back-grey has taken place it is sometimes difficult in certain types of pattern to detect this particular kind of mark-off.

MARKING-OFF IN DRYING AFTER PRINTING

Another way in which this fault may arise is from the drying cylinders of the printing machines. In a great many cases drying is carried out by means of hot flues, but in some of the older types of machines a range of drying cylinders is the only provision made for drying the goods immediately after printing. There is one drawback to this arrangement, if heavy prints are being done there is a danger of the moist print smearing or lifting off on to the drying cylinders during the passage of the goods over the range. If this happens, the consequence is bound to be a mark-off on to some of the unprinted portions of the material as it passes over the cylinders. Some forms of this type of mark-off are much worse than others, as not only is the color lifted, superimposed in irregular patches on the succeeding prints, but the color thus lifted has in some cases a discharging or resisting effect on the prints concerned. Such an instance as this may be cited here as an illustration.

A range of prints in fast colors was being printed. All of them but one combination of colors were of the vat series, the other colors concerned being azoics which were of equal fastness to the others. The vats were printed first and when the azoics were printed it was discovered that some portions of the prints at the beginning of the run were more or less discharged. On investigation, the cause was discovered in the drying cylinders, the first one or two of which had lifted a certain amount of the vat color during the passage of the prints. The color so deposited had then lifted or marked-off on to the succeeding azoic prints with the result that the reducing agent present in the vat color had acted as a discharge on the parts of the azoic prints affected. In cases of this kind, the only remedy is to print the azoic colors first, when the drying cylinders are clean, or else see that the cylinders are well washed before proceeding to print any azoics.

STEAMING MARK-OFF

Marking-off under the influence of steam is another type of the same fault which in such circumstances is also known as sublimation. The occurrence of this fault with certain types of color creates special difficulties which in some cases are such as to preclude the use of the colors entirely. Among dyestuffs which have this tendency is the group known as the alizarine colors. These colors will mark-off in nearly any circumstances except in the case of very light tones. In the first place it should be explained that marking-off or sublimation can only take place under certain steaming conditions, e.g., when steaming in a cottage steamer or in such an apparatus as the indanthrene steamer, if proper precautions are not observed. Where the use of the festoon steamer is the rule no trouble of this kind is ever experienced.

*Reprinted from Textile Recorder.

Most brands of alizarine colors will mark-off in the cottage steamer if the goods are not carefully greyed beforehand. The very bluish shades of red with alumina mordants are the worst offenders in this respect, while all brands fixed with chrome mordant (acetate of chrome) will mark-off very freely in the same circumstances. Certain mixtures of the alizarines however with other colors will not mark-off in this way even with chrome mordants. The writer has in mind such mixtures as alizarine orange with Persian berry extract for bright tan shades fixed with chrome mordant.

The practical difficulties created by this particular trouble are principally those of finding suitable shades to match those discarded. It is well known that very rich tans for chrome mordant prints can be obtained by the use of the alizarine colors with various other yellows, blacks, etc. Not only are such colors rich in tone but they are as a rule cheaper than other substitutes and for these reasons they are very desirable adjuncts to the colorist's palette. If then a demand is made for shades of this type in bulk printing by roller the difficulty arises of steaming the goods in a cottage steamer without marking-off. Where the use of the cottage steamer is adhered to, the only remedy is to grey the goods. This consists in reeling the goods on to collapsible reels, each piece along with a back-grey, which, as it is reeled on along with the cloth, interposes its thickness between each lap of printed material. Thus the mark-off, when it does occur, is intercepted by the grey and the material remains unsoiled.

It will be apparent at once that where large runs of prints are involved, such a remedy is cumbersome and slow, not only in consequence of the necessity for a large number of back-greys but also by reason of the fact that a longer time of steaming is rendered necessary, in order to penetrate the extra thickness of the grey. Suppose the ordinary time of steaming to be one hour, then 1½ to 2 hours will be necessary to complete the work of fixation when using back-greys. As previously mentioned, however, these difficulties can all be avoided by the use of the festoon steamer and in some particular printing processes the rapid ager.

The explanation of this mark-off seems to be the sublimation or vaporization of the actual dyestuff in the print color, by the steam under pressure, as used in the cottage steamer. The mark-off takes place on a portion of unprinted material which is in actual contact with a printed part and takes the form of an exact though fainter repeat of the object in question. In some cases a mark-off is not a serious matter as an ordinary treatment with chemick or bleaching powder solution is sufficient to remove it after the goods have been washed-off in the ordinary way. In others, however, the damage may be more serious, the mark-off being so heavy as to preclude its removal by any ordinary means. Where deep colors are in use it is best always to use thick greys or as has been suggested already, find a substitute. In deep shades the writer has seen a color marking-off even through a fairly thick back-grey.

MARKING-OFF WITH SILK COLORS

Of the silk colors, including acids, basics, vats and chrome mordant colors, the only one which is free from the fault of marking-off is the vat series, for the simple reason that such colors are fixed by a passage through the rapid ager and so do not afford any opportunity of marking-off. The others are all fixed by a long steaming in the cottage steamer, festoon steamer or several passages through an ager. The danger here lies in the use of the cottage steamer, the other two methods being immune from this trouble. Certain types of acid colors are prone to mark-off and the basics are no less noted for their tendencies in this direction. One feature in favor of silk print colors of this type is that they are usually made up with British gum or a similar substance as the thickening agent which mitigates the mark-off to some degree. It has been noticed that colors made up from British gum have less tendency to mark-off than those composed of starch or starch-tragacanth. This may possibly be explained by the greater density of the former medium as compared with the tenuity of starch and similar mixings which would probably not present so great an obstacle to the vaporization or sublimation of the actual dyestuff.

A further source of marking-off in silk colors is found in the washing off process, which should always be of the continuous type. The washing tanks proper are situated in front of a drying machine and the goods after being well rinsed in the open width are then lightly soaped, rinsed again and passed through a mangle on to the drying cylinders, the whole process being carried out in the open width. If any attempt is made to wash such colors and hydro-extract them or leave them in a wet pile, then marking-off of a serious kind is sure to take place.

● GENERAL RELEASES

General Dyestuff Corporation announces release of the following products. Copies of bulletins describing these products are available upon request.

Fastusol Violet 2BA—which is said to produce on cotton and rayon bright shades of a bluish violet and to also have good affinity for pure silk from a neutral or acid bath producing, however, a shade much redder than that on vegetable fibers. The dyestuff is said to leave acetate clear.

Indanthren Brilliant Green 4G Extra Paste Fine—a new product manufactured by General Aniline Works and offered to the trade by General Dyestuff Corp. It may be used either in dyeing or printing and is said to produce bright yellowish greens of very good fastness to light and washing and good fastness to chlorine.

Indo Carbon IB Suprafix—a brand which is said to be particularly suited for the printing of cotton or rayon.

Fastusol Red L5B—a direct color said to be of superior fastness to light and also to be suitable for cotton-rayon mixtures, leaving acetate white.

UNWANTED CREASES IN WOVEN AND KNITTED FABRICS

(Continued from page 386)

rials during finishing is based on the large effect of these conditions on the plasticity of wool. It is thus easy to produce creases in the wet processing of wool fabrics.

Both woven and knitted wool fabrics are liable to become permanently creased but one example will be given in connection with knitted material. Fabric having a raised patterned effect due to the type of knitting employed in its manufacture was scoured with a soap liquor in a winch machine and then washed with hot water. It was then wound round the winch (so as to be out of the liquor) and left overnight before continuing with the dyeing. Under these circumstances the fabric was thus left lying for several hours in rope form while hot and the layers of fabric were pressing somewhat firmly upon each other owing to the tightness with which the fabric had been wound on the winch. Next morning it was found that the fabric was badly creased and that a further simple scouring process failed to remove these creases. Actually no method for putting the fabric right was discovered although the fabric was steeped, dried, and finished several times under various conditions.

Silk, in spite of its high elastic properties, is susceptible to creasing. It is noticed most particularly in woven and knitted fabrics which have a prominent rib effect. Generally it would seem that with this fiber the creasing which occurs is mainly due to the type of fabric rather than to easy susceptibility of the fibroin itself to creasing.

The subject of crease formation in fabrics can be considered from quite another point of view. It is found that the degree of twist in the yarns which compose a fabric, whether woven or knitting, has a special influence on the liability of the fabric to crease during wet processing. In general, the higher the degree of twist the greater is the creasing liability.

When a tightly twisted yarn is placed in a hot processing liquor it tends to untwist and shorten in length at the same time. This is because with wetting, each fiber in the yarn increases in diameter considerably and this swelling can only be accommodated by untwisting and length contraction. But when such yarn is present as weft or warp in a woven fabric and this is then immersed in hot water the highly twisted yarn can only endeavor to untwist and contract in those parts where it is not interlacing with adjacent yarns. Also, since it cannot untwist owing to its ends being fixed in the selvages of the fabric the yarn can only contract in length and take up a contorted form which serves to reduce the amount of twist indirectly. Under these circumstances the surface of the fabric becomes puckered, and if the yarn is suitably distributed in the fabric this takes a characteristic crepe appearance.

It will be seen that the puckering occurs where portions of the yarn are free to become distorted in its endeavor to untwist, so that if the fabric is creased at this period then the distortion will occur along the line of crease. The new form taken up by the yarn is the most stable that can be secured under the circumstances and consequently the crease remains permanent no matter how much the fabric is afterwards washed and pulled.

Creases in fabrics containing highly twisted yarns can thus be easily produced if the fabric is held in a creased condition for a few moments while it is immersed in a hot scouring or dye liquor. It is for this reason that creases are easily formed in the woven crepe fabrics which are so popular today. Such creases absolutely spoil the appearance of the fabric, and once they are formed they cannot be eradicated without completely changing the characteristic nature of the fabric.

But today, real silk stockings are largely made with yarn which has a considerable amount of twist. Thus a certain amount of care is required in the first degumming process to which they are subject. If this is carried out rapidly and while the stockings are tightly twisted about each other (as is the case if the stockings are treated in mesh bags to protect them from chafing) then small puckers are formed and these detract from the appearance of the finished stockings. This defect can be avoided by slower degumming.

In reviewing this question of unwanted creases in fabrics it may be asked if there is not some method for removing such creases. In reply it is stated that generally there is no satisfactory method except that of wetting the fabric and then drying it while stretched sufficiently to make the creases much less noticeable. But after this treatment the fabric has a thinner handle and flatter appearance than is often desired. Yet there is one other treatment which can sometimes be used and this yields a better result. The fabric can be embossed with a small all-over pattern and this serves to obscure the creases while leaving the fabric with an attractive appearance. Perhaps this is the only really satisfactory corrective treatment but unfortunately it is one which cannot always be applied.

● THERMOMETERS

A new industrial thermometer catalog has just been issued by the C. J. Tagliabue Mfg. Co., of Brooklyn, N. Y. The catalog (No. 1125) contains 24 pages of conveniently arranged listings of the complete TAG line of industrial thermometers, miscellaneous metal and woodback thermometers, hygrometers, U gages, mercurial vacuum gages and mercurial barometers.

The company will be glad to send a copy of this valuable catalog free on request.

Technical Notes from Foreign Sources

New Discharges (Printing)

M. Richard—TIBA 10,803 (1932)—*Pli Cacheté No. 2,212, Bull. Soc. Ind. Mulhouse, Mars* 1932, *pp.* 185-194). —This new procedure consists

a—in mordanting a weave with a tannin solution of 40 g. per liter, fixing with tartar emetic, and impregnating to saturation in a bath of a basic dyestuff not resistant to hydrosulfite.

b—in printing a color, containing a basic dyestuff resistant to hydrosulfite, with Hydrosulfite NF conc.

c—in passing the goods through a Mather Platt to reduction, then for two hours of continuous steaming, then washing and soaping.

The same mordant, tannin-antimony, forming with the first basic dyestuff, the ground color, has the power (after discharging of the color by the hydrosulfite) of fixing the second color printed with the hydrosulfite—that is, the second color is substituted, in the tannin-emetic lake for the first color, where this has been over-printed by the second, the discharge-fast-color paste.

The dyestuff is well fixed upon the weave; it is as fast toward washing, soaping, etc., as though it had been printed in the ordinary way upon a white weave with a printing-color containing tannin, and passing through a tartar emetic bath after steaming.

For grounds of a medium color-depth, which would require a mordanting of 25, 20, or 15 g. of tannin per liter, for example, the dyeing will then be a little more delicate; for, in some cases, reds particularly, a preparation with a 40 g. per liter bath will be absolutely necessary, in order to fix them well by steaming. In such cases, they cannot be saturated as above mentioned.

In working in the cold, with a little care, one would be able to get, on the jig, dyeings not saturated, and dyed through, with 40 g. of tannin per liter. But the author prefers to work in the following manner: passage through the Foulard, with good squeeze-rolls, about four times, the weave being mordanted with a bath of 40 g. of tannin per liter, cold, the color being added little by little to the bath during passage; finally washing and squeezing, either in the same Foulard used for the dyeing, or in the common water-mangle.

For attaining very clear dyeings, pad four times in the Foulard with a solution containing

Basic dyestuff (at most)	1,0—4.0 g.
Acetic acid	80 g.
Water	quant. suff.
Tannin	40 g.
Acetic acid	40 g.
Water	quant. suff.

Make up to one liter. After foularding as specified, leave rolled up for some hours, then pass through a tartar emetic bath and wash in the Foulard or water-mangle.

This method of dyeing is very satisfactory; it can serve equally well for superimposing direct colors, which are thus applied in the same operation, brightened, and mordanted in tannin (40 g. per liter) and antimoniated; that is, made completely ready to receive the impression of the discharge colors. The actual fixing of these ground-colors in the cold is continued through two hours of steaming; they are of excellent fastness, after all the operations are complete (i.e., when the goods are turned out completely finished).

The discharges mentioned in the sealed note can likewise be printed upon all the grounds which one obtains with direct colors, directly coupled colors, or developed ones, these being naturally applied after padding in the tannin-antimony mordant.

It is absolutely necessary to subject the dyed and printed fabrics to a long steaming, without which certain dyestuffs, particularly the rhodamines, which form the foundation of the reds and violets, will not become fixed; now, during the long steaming, certain decomposition-products of the first dyestuff (the ground-colors) tend to reoxidize, and to dull, more or less, the freshness of the printed-on colors, particularly the blues and the greens. The author has found that the addition of potassium sulphite to the printing-paste will completely prevent the printed design from fouling in this way; it is probable that this reducing agent, more stable than the hydrosulfite, prolongs the reducing action, after destruction of the Hydrosulfite NF, without preventing the fixation of the printed-on coloring-matter.

Some of the recipes employed are as follows:—Color I serves for all dyestuffs, Color II for red, which does not well bear the addition of sulfite, the Rhodamine 6G base fixing very difficultly in the presence of a reducing-agent of even slight reducing power:

Color I

Basic dyestuff	5 to 30 g.
Glycerol	40 g.
Alcohol	130 g.
Paste BD	575 to 550 g.
Hyraldite C powder or Hydrosulfite NF conc., according to the ground	100 g.
Potassium Sulfite of 45°	150 g.

Color II

Rhodamine 6G extra	30 g.
Auramine G	5 g.
Glycerol	45 g.
Alcohol	150 g.
Paste BD	650 g.
Hyraldite C powder	100 g.
Potassium sulfite of 45°	20 g.

(Paste BD is composed of British gum, 500 g., dextrine, 80 g., water, 420 g.)

Paste BD possesses a reducing power which reinforces that of the potassium sulfite, and gives a print quite free from specks and fringes. The pastes being simple solutions of dyestuffs, free from tannin or other mordants, which could bring about precipitation during use, can be printed without fear of any difficulties, in designs involving large flat areas, on any kind of weave.

A satisfactory discharge for white can be obtained by substituting Rongalite CL for Hyraldite C, by addition of caustic potash and potassium sulfite to the paste, and by omitting the dyestuff. The Leucotrope W contained in the Rongalite CL destroys completely the ground color, without fear of subsequent oxidation; the sulfite prevents the oxidation of the tannin during the long steaming, after the destruction of the formaldehyde-sulfoxylate is complete; the caustic facilitates the elimination of the decomposition-products, and of the tannin.

White T

Blanc fixe	80 g.
Paste BD	400 g.
Rongalite CL powd.	200 g.
Potassium sulfite of 45°	200 g.
Caustic potash of 40°	120 g.

After printing, the goods are passed through the Mather-Platt for reduction, then steamed continuously for two hours, then washed and soaped. Instead of steaming for two hours, the goods can be steamed under pressure for one hour. After passage through the Mather-Platt, the discharge is accomplished; the colors are well reduced, but must still be completely fixed.

If the goods were to be soaped and washed after leaving the Mather-Platt, after having been left for awhile for reoxidation, a great part of the dyestuffs in the colored imprint would wash out, and the same would be true if the time in the Mather-Platt were doubled or trebled. This inconvenience, of incomplete fixation of the print-colors, is only relatively important when only clear blues, greens, or pinks of ordinary depth of tone are printed on, and also when not too great a demand is placed upon their solidity; the question becomes serious when we are dealing with medium-deep blues, olives, russets, and above all good reds. In the latter case, the difficulty is still greater, for the rhodamines, the only dyestuffs capable of producing a true red, possess a fixing power which is very slight, especially in the presence of hydrosulfite, and in the steaming do not begin to fix until the hydrosulfite has been completely destroyed.

The solidity of the colors, bottom as well as printed-on, is excellent. They can be subjected to a long and vigorous soaping at 50° C. without danger; it is only at about 70°-80° C. that the tones begin to lighten a little.

The referee who has examined the above procedure reports that the discharging of basic colors with hydrosulfite-formaldehyde is not new, but that the other points involved, with their incorporation into a single process, are new, and that the paper is a valuable addition to the literature and praxis of printing.

Yellow Azo Dyestuffs (Pyrazolone-Azo)

German Patent No. 472,488 (2/III/'29)—*I. G. Farben-Ind. A.-G.*—This patent specifies the use of one first component, 2-5-6-trichlor-3-amino-1-methylbenzene-4-sulfonic acid, diazotized and coupled to suitable pyrazolones, such as p-sulfophenyl-3-methyl-5-pyrazolone, p-sulfophenyl-5-pyrazolone-3-carbonic acid or its esters, or derivatives of any of these. The chief property of advantage claimed for the products, which, as was to be expected, are all yellows, is their fastness to light, which it is claimed far surpasses that of Flavazine 3GL and Fast Light Yellow 3G, which are certainly to be considered to be of excellent fastness to light. The product described in the one example is stated to be of good fastness also to washing, soda, and decatizing.

Blue Sulfur Dyestuffs

German Patent No. 477,697 (12/VI/'29)—*I. G. Farben-Ind. A.-G.*—German Patent No. 445,270 describes vat dyestuffs of the quinone type, obtained by condensation of the acylamino derivatives of o-amino-arylmercaptans with aryl quinones, especially halogen derivatives of the latter. The present process covers the conversion of these products to sulfur dyestuffs by the usual alkali sulfide melt. One example is given—a blue dyestuff.

The products appear to be related to the blue sulfur dyestuffs obtained from indophenols or leuco-indophenols obtained from diphenylamine and nitroso-phenols, but are much faster to light and washing.

Vat Dyestuffs (Anthraquinone Series)

German Patent No. 478,048 (18/VI/'29)—*I. G. Farben-Ind. A. G.*—This process consists in the condensation of hydroxy-anthraquinones, as quinizarine, purpurine, 1-4-8-trihydroxy-anthraquinone, and 1-2-4-5-8-penta-hydroxy-anthraquinone, by heating with ethylene diamine. The nature of the new products is not known, save that they contain nitrogen. Some of the products are capable of use as dyestuffs, (disperse type) for acetate silk, and all are useful for further elaboration in various directions, as intermediates.

Three examples and one table are given.

Azo Dyestuffs

German Patent No. 477,449 (7/VI/'29)—*I. G. Farben-Ind. A.-G.*—The process covered by the specifications consists in the coupling of diazotized o-nitro-arylamines to acetacetic arylides, and sulfonation of the products, or in coupling the same nitro-amines to presulfonated acetacetic arylides. The products are soluble in water, and dye wool in level tones of yellow, decidedly fast to light and fulling.

Two examples are given.

Contributions to the Study of Substantive Dyestuffs

M. Lesbre—TIBA 10, 739 (1932).—A continuation of which a previous part has been mentioned in these columns.

The present section deals with the physico-chemical behavior of Congo Rubine toward solutions of electrolytes, this dyestuff having been chosen for study because of its sensitivity toward such solutions. Work has already been carried out upon various aspects of the behavior of the dyestuff, by Ostwald, for example, Vles, Pihlblad, and Hantsch.

It is interesting that solutions of Congo Rubine under some conditions change color, from the characteristic fine, pure red, to a blue, by mixture with certain quantities of acids (which is not surprising), bases (which is rather surprising) or neutral salts (which is very surprising). In reference to the latter fact, at least, such blue solutions return to red by heating, and on cooling become blue again; the solutions which are red at the ordinary temperature, on being chilled to 0° C. and kept at that temperature for some time, become blue. If the amount of the salt present is sufficient, a blue precipitate may be formed in a red superstratum of liquid. The solutions which have been converted to the blue form by addition of electrolytes become progressively red upon dilution; on dialysis, the blue solutions do not yield a blue dialysate. In connection with this fact, it may be noted that the blue solutions display dichroism and the Tyndall cone more strongly than do the red solutions.

Ostwald and Pihlblad explain these and related facts by the theory that Congo Rubine in solution behaves as an electronegative suspensoid colloid, in which the color of the particles possesses a definite relation to their state of aggregation. The transition from red to blue indicates an increase in the size of the particles and a tendency to flocculation, while the transition from blue to red indicates an increase in the degree of dispersion—peptization, and a tendency toward the form of a true solution. The author agrees with this view. Hantsch characteristically postulates the existence of both the dyestuff and the dyestuff acid in two isomeric forms, each of different color, the shift of color toward blue indicating the passage of the azoic to the quinonoid form, etc.; but if such different forms do exist, there is no evidence whatever to prove it, and the hypothesis remains a mere "view."

Stengel's principle applies to the case of Congo Rubine, the author considers. This principle requires that every tendency toward agglutination of colloidal particles is accompanied by an increase in the amount of light absorbed, and vice versa. In this case, it is the quantitative variation of light absorption, and not the consequent variation in color-tone, which is of interest.

Much actual work along this line is chronicled by the author. Several quantitative tables and graphs are included in this section of the paper.

While the paper is of interest only to those concerned with the theoretical aspect of the behavior of dyestuffs in solution, yet this aspect is surely one of the means by which our practical knowledge of dyestuffs as dyestuffs will ultimately be increased. For the theoretical worker (and of course we can never tell at what point pure theory will suddenly enforce a revision of our knowledge of facts), we think this paper as a whole to be valuable and interesting.

Woad

L. B.—TIBA 10, 751 (1932).—A descriptive, historical essay of about two pages, upon a plant which up to seventy years ago formed the source of a very important and much-used yellow dyestuff. It is a species of mignonette, so familiar in our gardens.

The coloring-matter is a tetra-hydroxy-flavone, luteoline. Kostanecky, who did so much work a generation ago upon natural coloring matters, succeeded, with his students, in synthesizing it. As a dyestuff, it possessed certain disadvantages in comparison with quercitron, which about 1855 began largely to replace it. It is still used, however, in dyeing silk for yellows, with an aluminium or tin mordant. The dyeings are of good fastness to light and to soap.

Bleaching with Hydrogen Peroxide

TIBA 10, 753 (1932).—Principally a description of a method of bleaching with peroxide by means of a special arrangement of apparatus (of which a cross-sectional sketch is given).

Identification of Dyestuffs Upon the Fiber

L. B.—TIBA 10, 757 (1932).—A continuation of a previous section of the paper.

Some hints are given which may be of help in the problem of identification. But, without wishing to hint any unfavorable opinion of the paper, which is a good one, we must express the rather despondent feeling that it will do little to help us out of the quagmire in which the task of identification is at present submerged. As to dyestuffs in substance, it is quite possible in many cases to identify them with a good deal of certainty, even to absolute identification, and in other cases to run them down at least to an approximate location in the Colour Index. But as to dyeings upon fibers, we can usually do little more than locate the color in a certain group, unless we demand a tique unreasonable amount of dyed sample, and an unlimited amount of time, neither of which conditions are to be met with in practical work.

Waterproofing of Fabrics

René Chesneau—TIBA 10, 761 (1932).—Also a continuation of a previous part of the paper.

This is of high value to one working with such matters. Practical recipes and directions are given for waterproofing with aluminium salts (acetate or formate, aluminium soaps, aluminium tannate, and electrolytic methods), with compounds of copper, with alginates, and with gelatine.

Delustering of and Damage to Artificial Silk

Fritz Ohl—Monats. f. Seide u. Kunst-Seide 38, 298 (1933).—The first part of a paper upon the subject of possible damage to artificial silk by the common methods of delustering.

As far back as 1920 patents were taken out for the production of more or less matte fibers of viscose. But it is only since 1927 that the process has been both diligently and successfully prosecuted. The delustering of piece goods can be traced back also to the same year. At that time and subsequently, the familiar processes involving the use of aluminium and of titanium compounds began to be used. In 1929-1930, with the introduction in England of the grade known as peau d'ange, such processes became normal for continuous industrial production. The tendency has been, all along, rather steadily away from the high luster of the untreated fiber, through increasingly duller luster, to what may comparatively be called the modern dead-matte or absolutely lusterless sorts. The same is true of acetate silks.

Fibers without luster (a better phrase than delustered) are producible by three general methods: through special additions to the spinning-mass or bath, through after-treatment of the yarn or weave, and through printing upon a weave.

The first method possesses its own literature, too extensive to be entered upon except in a paper specially devoted to that topic. It is enough to say here that such lusterless fibers are producible either by addition of organic compounds, fats, oils, etc., or of inorganic substances, mineral salts, metallic salts, sulfur, etc., or of soluble salts which are transformed into insoluble compounds during the spinning, to the spinning solution, with also possible modifications of the bath. Modifications in luster can also be brought about by alteration of the degree of ripeness of the viscose, by additions to the bath, and by certain alterations in the conditions of precipitation.

This paper is specially devoted to the delustering of yarns and weaves. There is a considerable number of preparations upon the market for accomplishing this result. The author employed simple, non-secret methods and materials, viz: barium chloride and sulfuric acid, barium chloride and sodium sulfate, sodium stannate and barium chloride, and titanium sulfate. The method consisted in impregnating the goods, after scouring, with dilute (2%) sulfuric acid, then passage at once, without washing, into a warm 3% barium chloride solution, followed by careful washing and drying. The method was varied by immersing the acid-impregnated material in cold barium chloride solution, and gradually warming to 70° C., also by reversing the order of bath. The substitution of sodium sulfate for sulfuric acid was made to check up upon any tendering from the free acid.

The best deep matte effects seem to be attained by hot treatment of bleached and scoured rayon (bleached by activin), though all results were considered good. Tests were carried out also to determine the resistance of the matte effect to washing (a natural question to raise, since the method of delustering employed would produce superficial as well as internal delustering). About the same result was reached—the samples most successfully delustered also best withstood washing (15 minutes, 5 g. soap/liter, 40° C.).

In this section one table is given, citing figures for breaking strength, elasticity, etc., of the samples delustered, washed, preserved for certain periods, etc.

Vat Dyestuffs (Anthraquinone-Triazine Series)

German Patent No. 476,411 (*May* 17, 1929)—*Gesells. f. Chem. Ind. in Basel.*—The dyestuffs involved as the starting-point are such anthraquinone vat dyestuffs, containing one or more triazine rings (C_1—N_2—C_3—N_4—C_5—N_6—) as are described in German Patent No. 390,-201 and additions thereto. Such dyestuffs are mentioned as giving fast dyeings upon vegetable fibers. The present procedure covers two points:

a—Treatment of such fundamental dyestuffs with aqueous hypochlorite "transforms" them into still faster dyestuffs; apparently only a method of purifying them, the impurities accompanying them as in the earlier procedure cited being destroyed by hypochlorite, which, it is worth noting, does not apparently attack the triazine ring, as would be expected. (Note—the triazine ring, according to our experience, is far more stable than appears to be supposed.)

b—The purified products, or at least those containing a reactive halogen in the triazine ring, are capable of condensation, e.g., with aniline, ammonia, water, alcohols, etc., to various derivatives. Five examples are given.

Vat Dyestuffs (Anthraquinone Series)

German Patent No. 475,766 (1/V/'29)—*I. G. Farben-Ind. A.-G.*—Reference is here made to orange dyestuffs described in German Patent No. 268,219. The present patent covers the production of other more valuable products by nitrating dinaphthyl acridines, reducing these nitro-derivatives, and in some cases acylating the amino compounds formed. In the two examples given, the products dye cotton very fast violet-gray and olive-gray, the latter dyeings being extremely fast.

● JULY TEXTILE RESEARCH

The July number of "Textile Research" comments editorially upon the very encouraging progress that is being made by the leading textile research organizations in interpreting current scientific research results in language that can be understood by the average technician, thus hastening the practical application of new scientific findings.

Examples noted are interpretative reviews of researches on wool carbonization and the chemistry of wool, conducted under the auspices of the American Association of Textile Chemists and Colorists. It is also stated that the warp sizing research, now being conducted at Massachusetts Institute of Technology by U. S. Institute for Tex-

tile Research, Inc., has had interpretation of its results prepared for in advance by the selection of committees having this responsibility.

The leading article in this issue is the "Interpretation of Data Obtained with Spectrophotometers of the Polarizing Type," by Robert D. Nutting. Mr. Nutting is a senior fellow of the Textile Foundation who has been studying under A. C. Hardy at M. I. T., and on the use of Prof. Hardy's spectrophotometer in the dye and textile industries. In this interpretative article he explains a simple method for translating data obtained with plane-polarized light to a basis of ordinary illumination.

Another Textile Foundation research report in this issue by Mearl A. Kise provides a very complete summary and bibliography of the work to date on the solution and regeneration of natural silk fibers, under the title "Silk Fibroin Dispergation."

There is brief reference in the same number to the first conference, June 29, of committees and firms co-operating in U. S. Institute's warp sizing research, at which the research director, J. R. Katz, delivered a lecture on the basic properties of starches. Some 35 of the 55 firms qualifying to receive confidential progress reports of this research were represented at the meeting. Dr. Katz is planning to lecture on gelatines and other sizing materials in the early Fall.

The following firms have recently taken out contributing memberships in U. S. Institute for the purpose of qualifying to receive confidential progress reports of the warp sizing research: Bigelow-Sanford Carpet Co., Thompsonville, Conn.; Bloomsburg (Pa.) Silk Mill; Drake Corp., Norfolk, Va.; Fairforest Finishing Co., Spartanburg, S. C.; Farr Alpaca Co., Holyoke, Mass.; Hart Products Corp., New York, N. Y.; National Adhesives Corp., New York, N. Y.; North American Rayon Corp., Elizabethton, Tenn.; Penick & Ford, Ltd., New York, N. Y.; The Texas Co., New York, N. Y.; Tubize Chatillon Corp., New York, N. Y.

● NEW DU PONT PRODUCTS

Five new products have just been announced by the Dyestuffs Division of E. I. du Pont de Nemours & Co.:

"Acele" Diazo Navy RD—a dyestuff produced especially for application to acetate fiber yarns and piece goods to produce an economical navy blue. It is extremely well dispersed so that uniform results are said to be assured, and when developed with Acele Developer A Extra, it is claimed that blues of good general fastness are obtained.

Sulfogene Red Brown 6RCF—a copper controlled sulfur color producing bright reddish shades of brown. It is stated that it not only is an excellent self-color, but will prove useful as a base for chocolates and red browns on all types of cotton materials, particularly where fastness to light is of importance. An unusual and interesting property is said to be that when properly oxidized it will not give the shade variations on ageing or be affected by atmospheric conditions as most of the red sulfur browns. It is further said to possess good general fastness and to be well suited for application in all types of machines.

Ponsol Golden Orange 4G Paste (Pat.)—a yellowish shade of vat orange said to differ chemically from any product previously marketed. It is a cold dyeing type, chiefly of interest on account of the excellent fastness claimed against light and weather. In addition, it is said to have very good fastness to chlorine and washing and good fastness to boiling in the presence of mild alkalies and soda ash.

Sulfanthrene Black PG Double Paste—for the production of jet shades of black on cotton, rayon, pure and tin-weighted silk and acetate fibers. It is said to be fast to light and power laundry both with and without chlorine, and having been prepared especially for printing, is said to be non-drying, non-foaming and grit-free. Moreover, it is said to reduce easily and oxidize rapidly. The manufacturers state that it is particularly suitable for the production of grays as well as for shading purposes, producing consistent shades of grays or blacks under both moist and dry ageing conditions.

Diagen Blue MGR and *Diagen Blue MGR 20% Solution*—chemically similar to each other, differing only in physical form. Diagen Blue MGR produces dark reddish shades of blue said to be of good fastness to light and washing. Like the other products of the Diagen group, this color is said to produce, economically, bright fast prints on both cotton and rayon. It is the belief of the manufacturer that it should find wide use in printing ladies' dress-goods and handkerchiefs where economy and good fastness are both requisites.

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